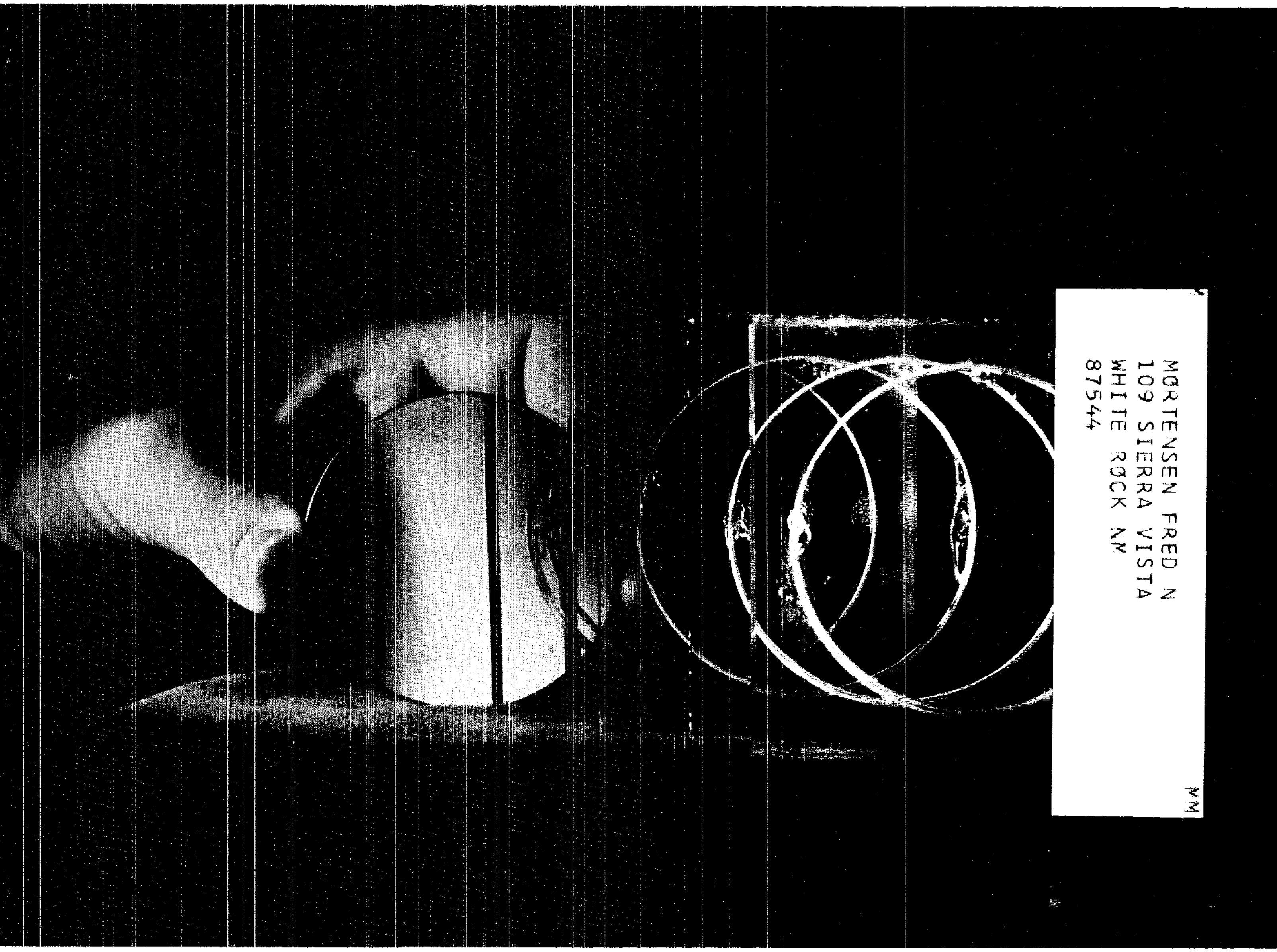

the Atom

Los Alamos Scientific Laboratory
July/August 1979

*the*Atom

Vol. 16, Number 6
July/August 1979

Publisher

Published monthly except for July-August and January-February issues by the University of California, Los Alamos Scientific Laboratory, Office of Public Information. Address mail to MS 318, P.O. Box 1663, Los Alamos, New Mexico 87545. Second class postage paid at Los Alamos, N.M. Printed by Westprint, Albuquerque, N.M. ISSN 0004-7023. USPS 712-940.

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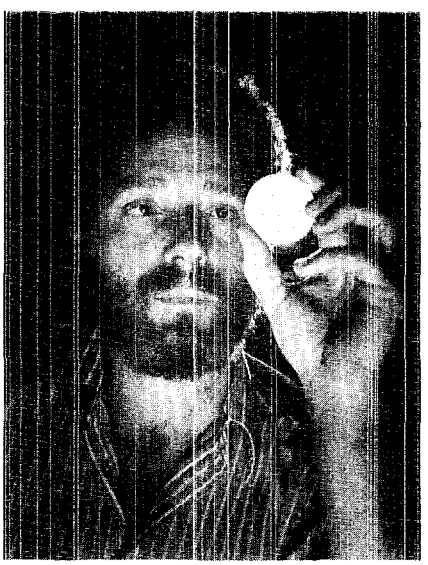
1325 Trinity Drive, Telephone (505) 667-6101. Address inter-office mail to PUB-1, MS 318.

ON THE COVER:
A germanium mirror, seen behind a group of calibrated optical attenuators, is part of the key to a new technique that helps to "trim" laser beams and direct them precisely to targets. Other photos by LeRoy N. Sanchez, and a story on the process, may be found beginning on page 20.



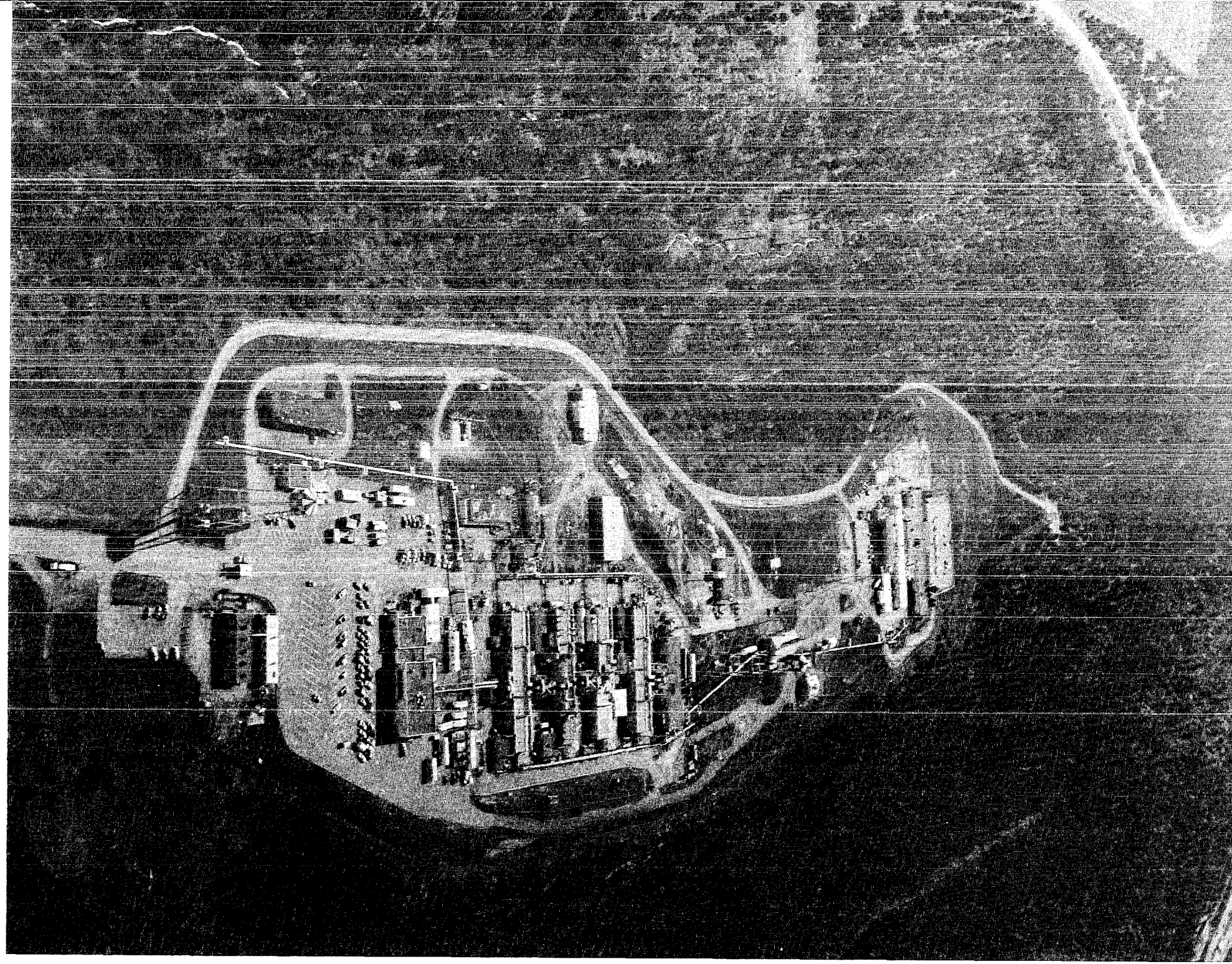
Preview:

DP West, a Los Alamos landmark since it was built 35 years ago, is no longer the site of plutonium handling operations for the Laboratory. As Group CMB-11 began its move to new quarters last year, a coordinated decontamination effort was begun at the old site. When finished, the work will have provided about 40,000 square feet of useable space for other purposes. The job is expensive, but the cost is about that of new facilities...

The first public tour ever offered to Indian ruins in a security area was a large success, despite the rain that fell during several hours of a recent Sunday. A related story on archeology, dealing with the discovery of two Indian pots uniquely joined with a lime plaster, can also be found in this issue...

Laser research work at Los Alamos is proceeding on many fronts. Four researchers have reported results of a phase-conjugation technique that can help to "trim" a laser beam. There may be other ramifications of this work as more testing occurs...

Los Alamos has a new Director, as of August 1. He is Donald M. Kerr, Jr., the fourth person to head the Laboratory since its inception in 1943. Kerr worked here 10 years before assuming a Washington post with the Department of Energy three years ago...



The remaking of DP West

By Jeff Pederson

DP West Site, a Los Alamos landmark with its many metal buildings and two water towers, was built in 1944-45 on a mesa parallel to the local airport. For years it housed the Laboratory's key plutonium handling operations, before they were moved to LASL's new Plutonium Facility at TA-55 in 1978.

John W. Anderson was involved in the original DP West design phase. Today, he is the last permanent Group CMB-11 employee at the site. When decontamination of the five buildings occupied by CMB-11 is completed late next year, Anderson too will leave, and the structures will be used for other office and research functions.

"Nobody knows just where the name DP came from," said Anderson. "But the old wartime buildings, in what is now downtown Los Alamos, were known as A, B, C, and D, so this one became D-prime, or DP. It does not mean Displaced People, as has been rumored."

In a massive team effort, persons from several LASL divisions and craftspersons from the Zia Company are working at the decontamination of DP West.

"This is the first time a plutonium facility of this nature and size has been decontaminated for reuse," said Anderson, "and it isn't cheap. It will cost about $6 million." At the project's conclusion, the Laboratory will have 40,000 square feet of useable space for other purposes. In the meantime, the work is the province of some three dozen persons who take radioactivity readings, dismantle equipment still in place, and ultimately provide LASL with a decontaminated facility for future users.

This aerial view, recently taken, shows DP West in the foreground and the smaller DP East in the background. A massive clean-up effort is now under way, as five buildings are being converted to uses that don't involve plutonium work. The Los Alamos airstrip is to the left.

Photo by Fred Rick

The plan

Such a major operation requires planning and attention to detail. In the summer of 1977, about 10 per cent of CMB-11's equipment was moved to the new Plutonium Facility, and the group's last operation was shut down at DP West this March. The cleanup work, involving the Health Research (H) Division, the Engineering (ENG) Department, CMB-Division, and Zia, began in the summer of 1978. Beforehand, CMB-11 removed all plutonium in process or in storage.

The H-Division persons on the scene are divided into an operations section, headed by Ray Garde, and a health physics section, headed by John Gallimore. Garde is also chairman of an H-Division task force for support activities, such as health physics, safety and fire protection, industrial hygiene, waste management, and environmental surveillance. Engineering services are handled by Darrell Hohner of ENG-14, and Zia has a full time field engineer, Mike Tomlinson, assigned to the project to direct Zia craft functions.

The decontamination objective is to remove all contaminated items that have resulted from 35 years of

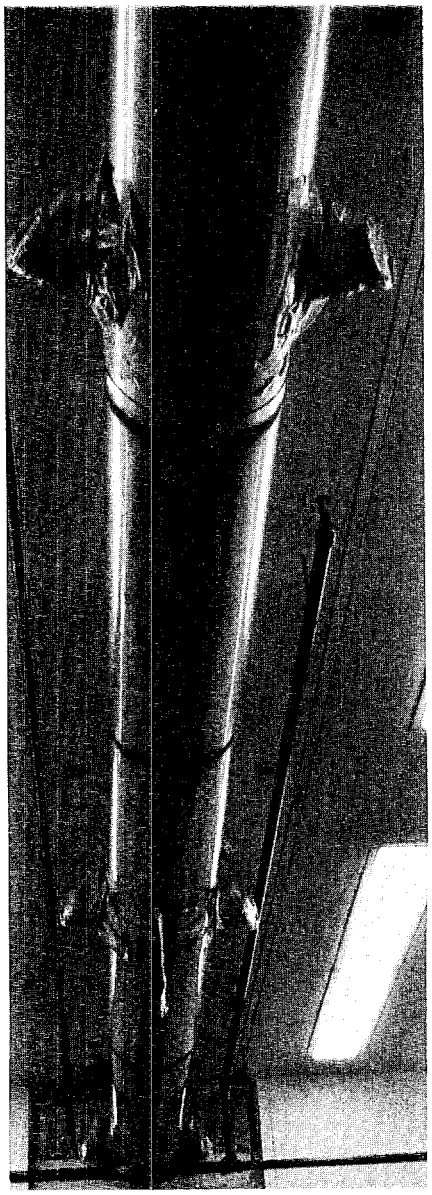


Photo by LeRoy N. Sanchez

A typical glovebox exhaust line, at ceiling level, awaits removal.

'The old wartime buildings were known as A, B, C, and D, so this one became D-prime, or DP. It does not mean Displaced People.'

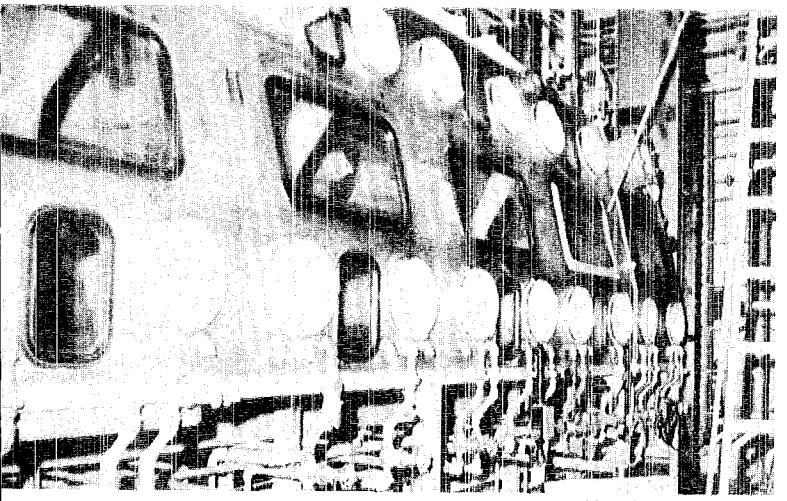


Photo by Tommy Velarde

Before decontamination, a glovebox room looked like this. Service lines must be disconnected and capped before the boxes can be dismantled.

Photo by Robert Pena

Ed Derr and Gary Wiechering of H-1 prepared this glovebox for an acid washing of its interior by drilling a hole to introduce a solution. This particular method of decontamination was later discontinued.

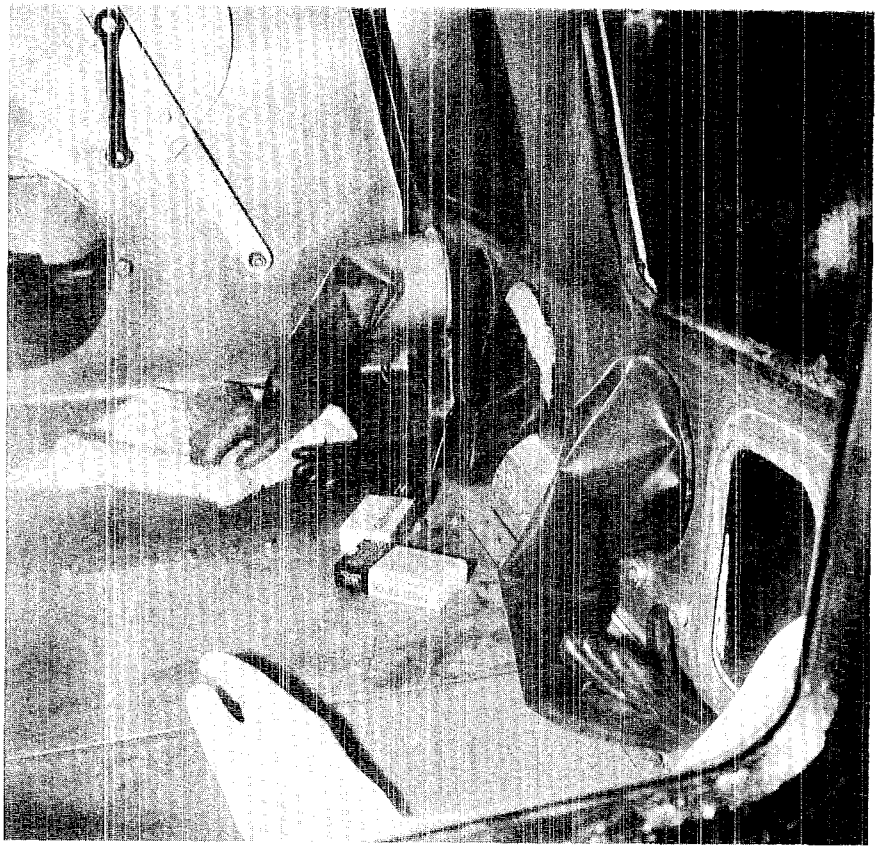


Photo by Bobby Stevens

The interior of a glovebox is cleaned before the unit is removed, or exposed to the air.

use at DP West. That means all handling equipment, including rows of gloveboxes and long overhead conveyors, must come out. Process piping, tanks, pumps, ductwork, and filters must be removed. Five contaminated industrial liquid waste pits, buried in the ground near each building, must go. Lines that have carried contaminated solutions, vacuum lines, and drain lines will be removed from the four-by-four-foot crawl spaces underneath the buildings. All openings in room floors formerly used for utility lines will be sealed with concrete. Walls, ceilings, and floors will either be cleaned or removed. An orange paint is applied to clean walls as they are checked by the work crews, and new tile floors are installed as the decontamination progresses.

"We went through all historical records at DP West and tried to identify where any spills or incidents had occurred through the years," explained Ray Garde of H-1. "We also talked to the oldtimers to find out what had happened, and what might have been painted over."

Retrievable storage

As might be expected, large volumes of wastes are generated by a project of this type. Wastes contaminated to a level greater than 10 nanocuries of transuranics per gram must go, as per Department of Energy directive, to "retrievable storage." Some gloveboxes and pipes thus are packaged in fiberglass-covered plywood boxes, lined with plastic, labeled as to date and former location, and stored at the LASL waste managment site. Wastes with less than 10 nanocuries transuranics per gram are buried as non-retrievable waste in pits designated for low levels of radioactivity.

To date, 2,500 cubic meters of non-retrievable wastes and 300 cubic meters of retrievable wastes have been delivered to TA-54 for storage or burial. These volumes are about one-fourth of the expected totals.

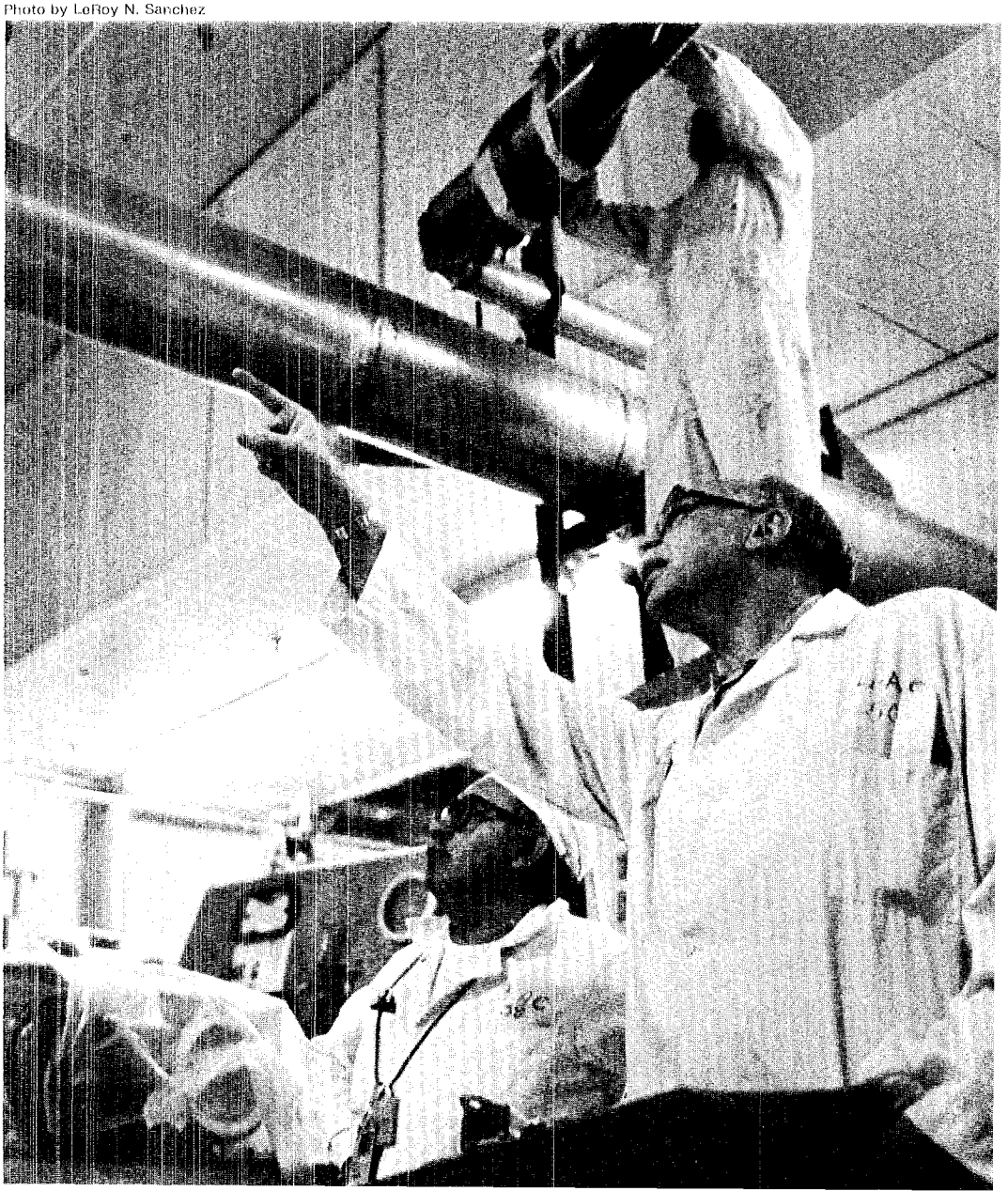
Originally, H-1 had planned to use an acid solution to wash down gloveboxes so they would read less than 10 nanocuries per gram of waste, thus eliminating the need for retrievable storage and future handling. The plan was discarded after experimentation indicated the technique to be hazardous (using acids) and time consuming, in addition to producing excessive amounts of additional liquid wastes. The procedure with gloveboxes and conveyors now is to measure the plutonium content by reading through a glovebox glove with an instrument that uses a small, thin sodium iodide detector to measure the low-energy photons emitted by the transuranic contamination.

Other probes are also used by H-1 to monitor alpha radioactivity. Portable alpha PAC-7 and Ludlum 139 instruments are used to check walls and ceilings once gloveboxes have been removed. A Phoswich detector measures x rays from the contamination, even through paint on walls and floors. Although beta-gamma and neutron radiations are not anticipated, measurements are made before areas are finally released.

At the conclusion of the $6 million project, LASL will have 40,000 square feet of useable space for other purposes. In the meantime, about three dozen persons are working on the clean-up.

Joe Vigil, H-1, and Bob Gilmore, CMB-11, discuss preparations for removing gloveboxes and pipes at DP West.

Photo by LeRoy N. Sanchez



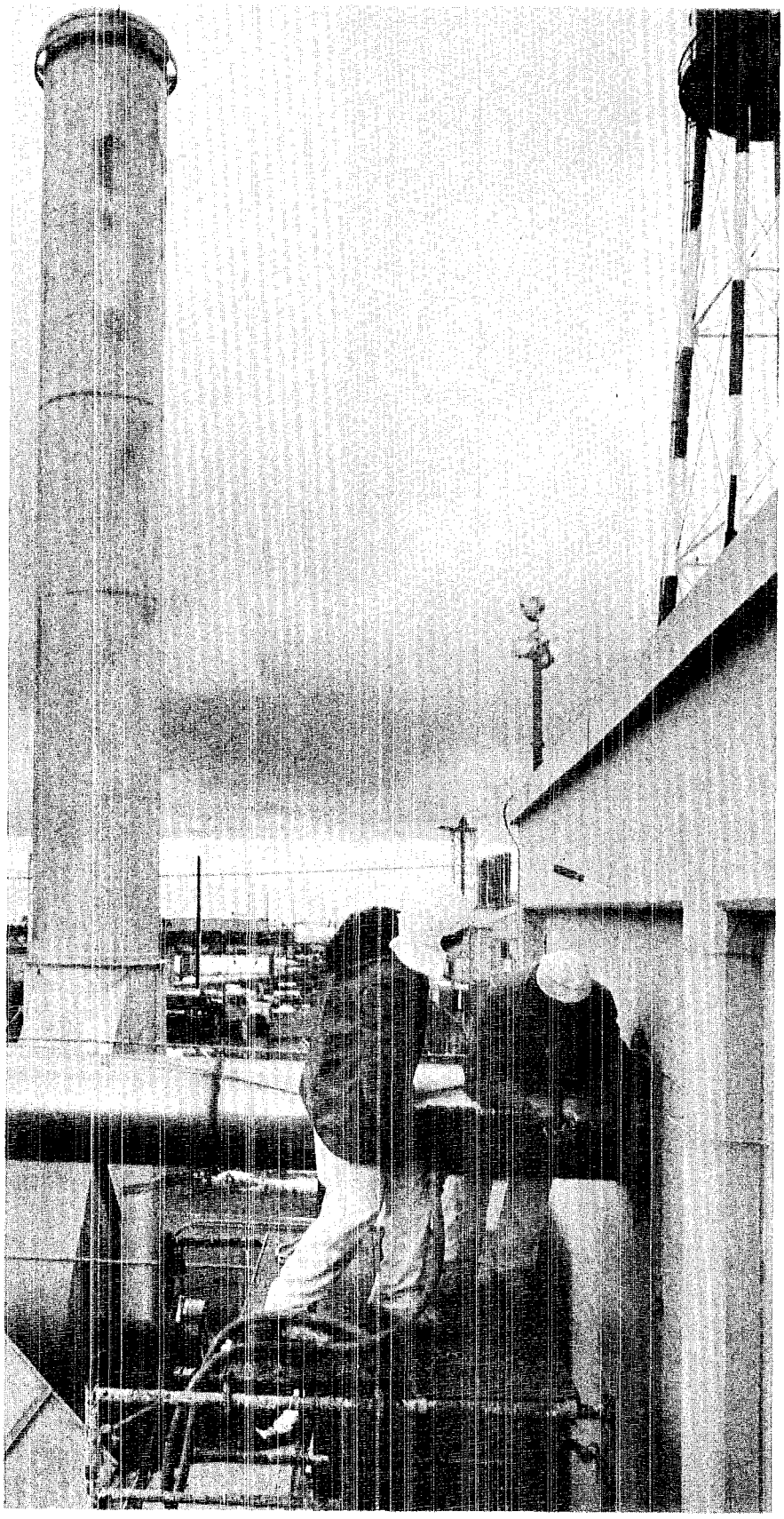
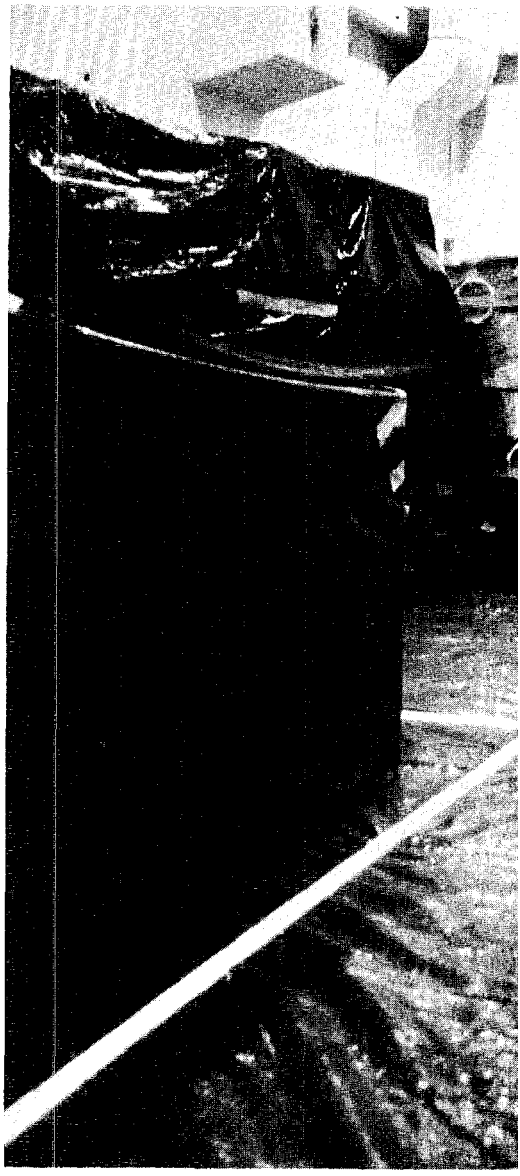


Photo by LeRoy N. Sanchez

On the outside, Zia tinners remove a section of exhaust piping where it meets a building wall.

Coming out are gloveboxes and conveyors, process piping, and waste pits. Floor openings



Charlie Arnold of CMB-11 helps to keep inventory of wrapped glovebox sections and pipes before the items

will be sealed, and walls and floors will receive new coverings.

Photo by LeRoy N. Sanchez

are sent to retrievable storage or to waste pits.

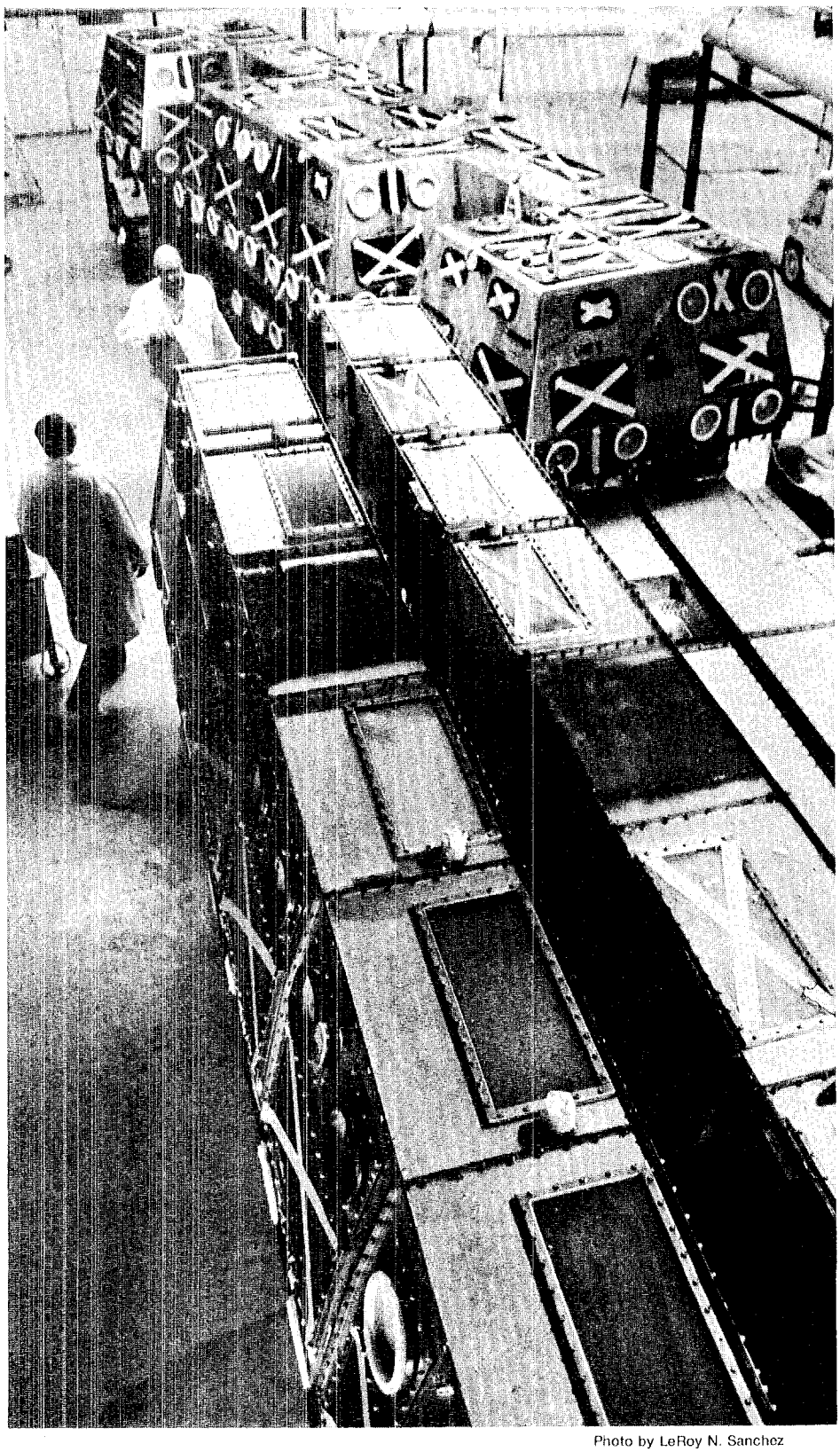


Photo by LeRoy N. Sanchez

Sections of handling equipment stand ready for packaging. They will be sent to retrievable storage.

Some items are packaged in special boxes, labelled, and stored underground in accordance with federal rules governing 'retrievable storage.'

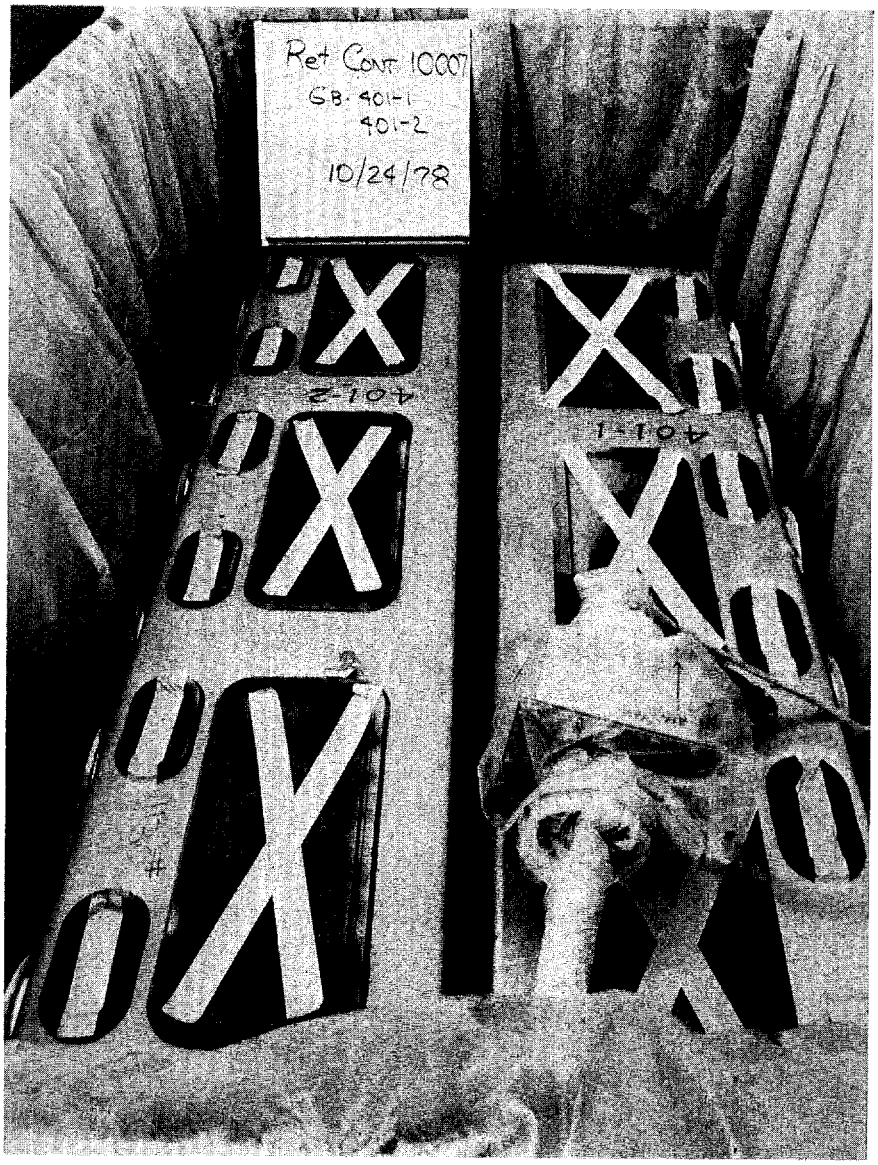


Photo by Winfred Headdy

Two glovebox sections are shown packaged for retrievable storage. For future reference, the container has been documented as to number, contents, and storage location.

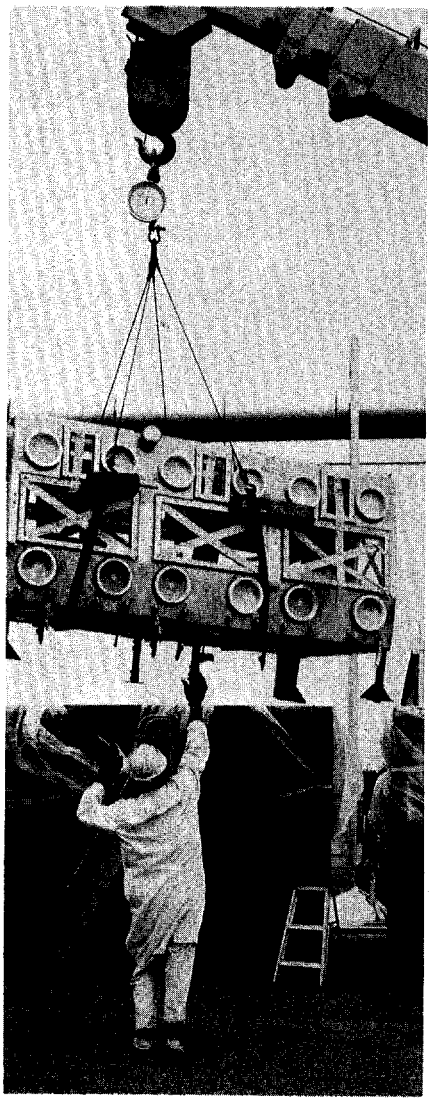


Photo by Winfred Headdy

Zia riggers work with a crane to load a glovebox section into a retrievable storage container.

Photo by LeRoy N. Sanchez

This section of contaminated wall at DP West was removed. Here, a Zia worker spreads plastic to protect the floor from bits of plaster that will result from a wall rebuilding project.

Photo by Winfred Headdy

Richard Romero, H-1, removed a small hot spot from the floor surface with an air chisel and a vacuum, using a bottomless glovebox to confine the contaminants.

Photo by Robert Pena

With an H-1 monitor on hand, Zia craftsmen removed contaminated lines from a section of floor.

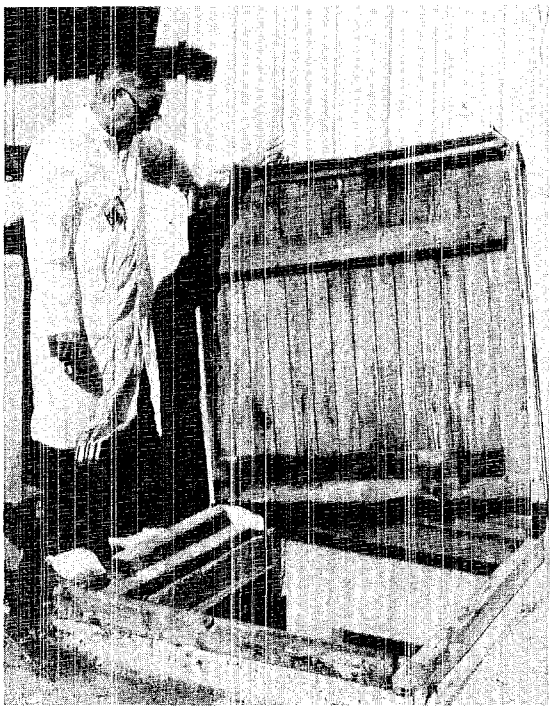


Photo by Winfred Headdy

John Anderson, who was a participant in the original design phase of DP West in the 1940s, displayed one of the entrances to the four-by-four foot tunnels that lie under buildings. The tunnels will be cleaned and sealed off.

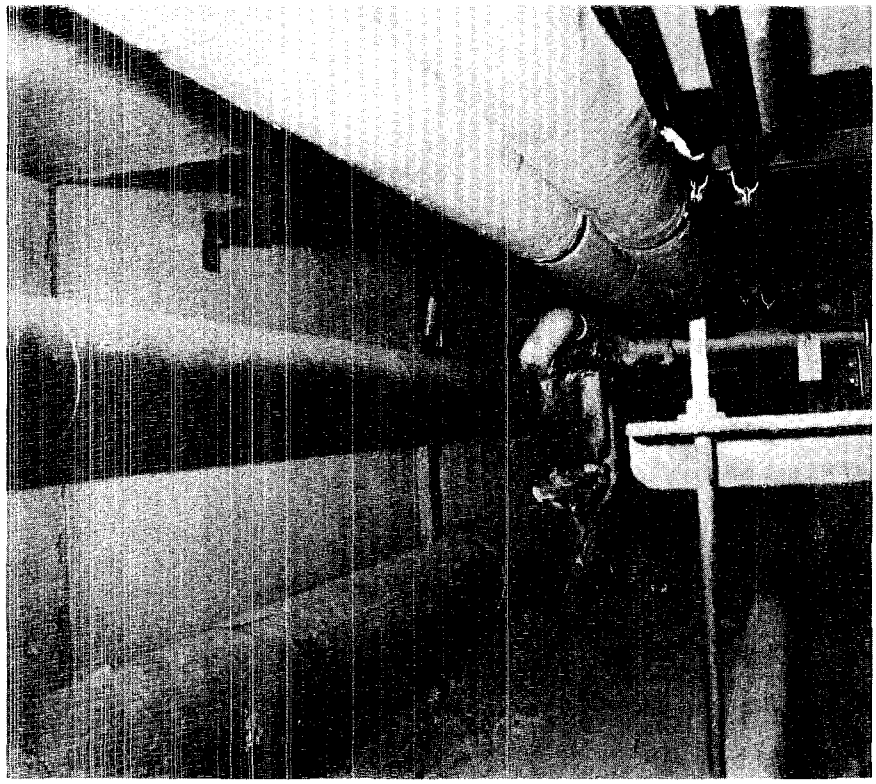


Photo by Winfred Headdy

A view of piping in one of the underground tunnels.

Metal separations

At the new Plutonium Facility, gloveboxes and overhead conveyors are put together in modular form. At DP West, they frequently are continuous, long sections that do not lend themselves to simple removal. At certain places, a separation must be made, and each end of a box section must be capped with a metal plate.

One of the last items to be removed is the exhaust ducting for a glovebox. It holds a negative pressure on the box, so any activity will be pulled toward special filters while decontaminators work.

"We have gone through more than 90 separations," said Garde, "with no reportable release of radiation or problems of any kind." During such stages of work, a glovebox interior is typically exposed to the external environment for a few seconds. Workers are wearing full-face respirators as a health precaution.

Some "hot spots" have been located on the concrete floors, where a spill may have been painted over, after cleaning, to fix any residual contamination in years past. To remove this contamination, a bottomless portable glovebox is placed over the area and a worker uses a small air chisel in conjunction with a filtered exhaust system to chip away and contain bits of the floor surface.

New occupants

As a precaution when the site is reoccupied in the future, H-1 will maintain a monitor at DP West, and Zia construction and maintenance orders will be routed before the group before any work takes place. Most likely, H-1 will control the keys to the underground crawl spaces that underlie the buildings' peripheries.

Future users will obtain space after a transfer committee has reviewed final conditions and contamination levels. The committee, chaired by Allen Valentine of H-1, will also include John W. Anderson of CMB-11; Joe Trujillo of ENG-4; John Gallimore of H-1 health physics; Ray Garde of H-1; a representative of the future users group; and consultant Dean Meyer.

A transfer memorandum will include any restrictions placed on DP West use and copies of the final survey report. Photographs taken during all decontamination stages by the Information Services (ISD) Department will be a part of this report. The new users will then know exactly the condition of the work space at the time they took it over.

The DP West office building has already been largely occupied by a geosciences group, and the former cafeteria now houses laboratory equipment, as does a locker room. No promises have yet been made for two of the buildings, but one Laboratory group (CNC-4) has been scheduled to occupy the easternmost building.

DP Site should be quite useable when it has been refurbished. In the early 1970s, about $4 million was spent on upgrading the site, with sprinkler systems, new piping, and other improvements. All the buildings have separate ventilation systems, and the views from the mesa are spectacular.

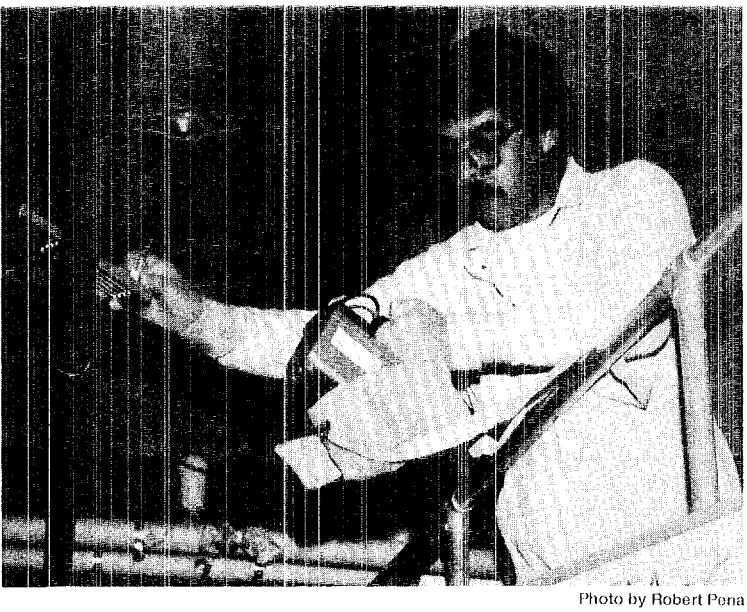


Photo by Robert Pena

Joe Trujillo, H-1, examines a pipe section for evidence of residual contamination.

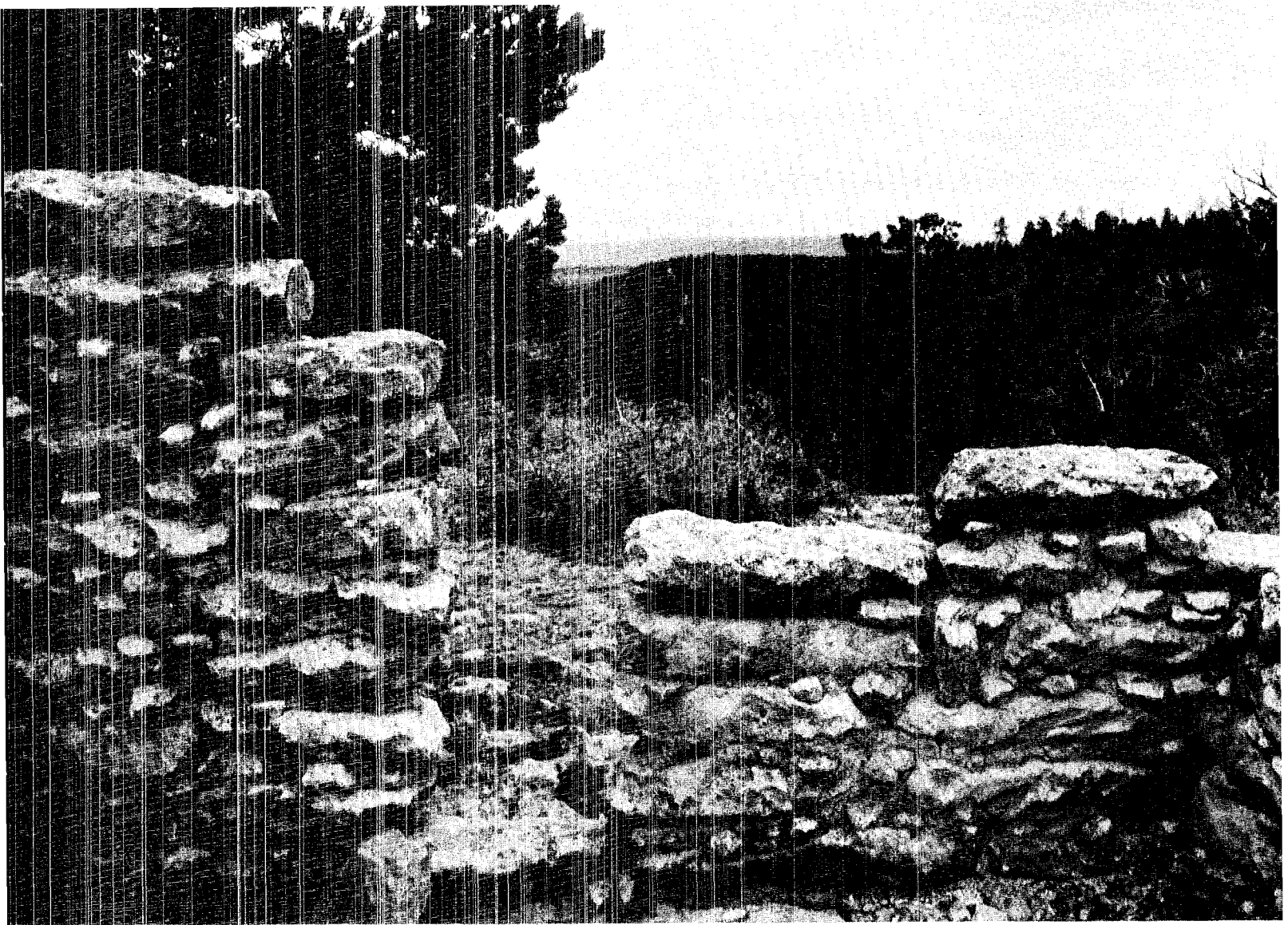
Photo by Tommy Velardo

Bob Dinwiddie, H-1, uses a sodium iodide counter inside a new glove to read radioactivity inside a glove box before dismantling.

'We have gone through more than 90 separations, with no reportable release of radiation or problems of any kind.'

Photo by LeRoy N. Sanchez

Before new users occupy space at DP West, Zia applies fresh paint to walls. Floors receive new vinyl coverings.



Photos by LeRoy N. Sanchez

At the eastern end of a narrow mesa, Nakimuu looks toward the Sangre de Cristo mountains. Canyons drop off on either side.

A place called Nakimuu

All around Los Alamos, the Pajarito Plateau is dotted with the ruins left by Indian inhabitants who had moved elsewhere before the Europeans came to New Mexico. In one of the Los Alamos Scientific Laboratory technical areas, one site contains the highest standing walls, and is the best preserved, on the plateau. Until recently, it was known only as Site LA 12655, and it had never had been open to the public since it is located within a security area used for testing.

May 30, more than 250 persons were able to see the little village that is now known as Nakimuu. PUB-2, the group that operates the Bradbury Science Hall and conducts tours of LASL facilities, coordinated half a dozen busloads of visitors to S-Site. Only the 9 a.m. tour was relatively dry; rain fell later but failed to stop the enthusiasts. They showed up with umbrellas, raincoats, and other wet weather gear through the early afternoon.

"The first morning the tour was announced, we filled up all the schedules," said John McHale, PUB-2. "For several days after that we still received 100 calls a day."

Nakimuu, a Tewa Indian name for "the point," is aptly applied. It was recently suggested by George Voelz, leader of the Health Research (H) Division.

The ruins, containing about 50 rooms, sit at the very eastern end of a narrow and nameless finger mesa. On either side, steep walls of volcanic tuff reach down to Water Canyon and Canyon del Valle. Many walls, made of cut tuff blocks set in mud mortar, stand chest-high.

"This is not a typical site," said LASL archeologist Charlie Steen, "because the walls are standing." That's unusual in light of Nakimuu's exposed location.

There are other anomalies.

There is no farmland close by, although there is land that could be farmed on mesas across each canyon. There are at least 10 door and window openings, but most Pajarito ruins have very few. There is very little pottery about, perhaps a few handsful of shards. What pieces have been picked from the surface indicate a Wiyo black-on-white style of the early to mid-1300s.

One room at Nakimuu apparently suffered a burned roof. Mud plaster on the walls was fired during the blaze, and visitors could see the fingermarks of the craftsperson yet embedded. It is rare to find a Pajarito ruin with evidence of roofs, said Steen, because the rafter poles — painstakingly cut to size by applying hot coals to tree trunks — were taken to a new home when an Indian community moved. Inhabitants also took almost everything with them, including useable pottery and tools. For reasons unknown, they also swept their floors clean and sealed fire pits with adobe mud before departing.

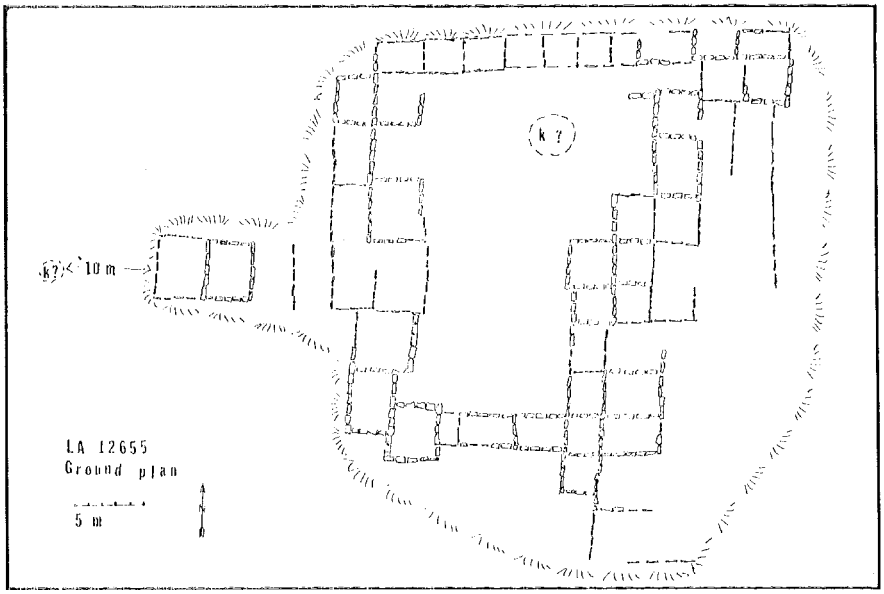
There may be a kiva, or circular ceremonial room, at Nakimuu. A second depression holds only a slight chance of having been a kiva, said Steen. Since the site basically lies on bedrock, a kiva would have to have been cut into the volcanic tuff.

Indian inhabitants were accustomed to much less water than are we. They would have thought little of a trip down the mesa to fill a water jug, one or two of which would supply the daily needs of a family of four, said Steen. No trail descending from Nakimuu has yet been found. "But I have seen Southwest ruins where the nearest possible water was five miles away," he added. Water gathering, probably a chore delegated to girls, could have been associated with games or laughter in a near-picnic situation.

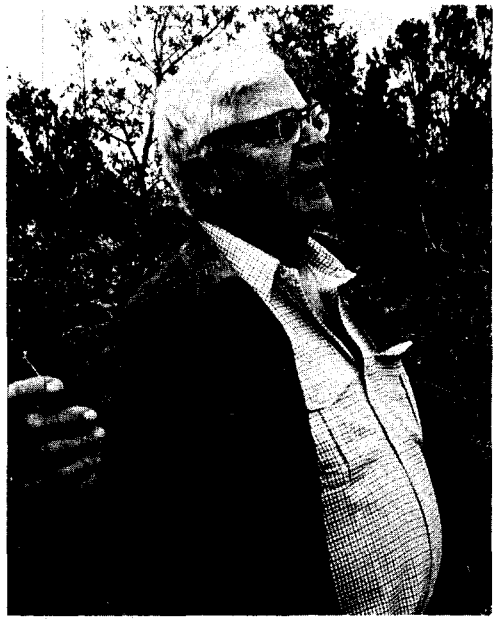
Masonry at Nakimuu shows a generally consistent style, but

The ruins sit at the eastern end of a finger mesa and contain walls still intact to chest height.

Tour enthusiasts were delivered to S-Site by the busload.



Ground plan shows a complex of about 50 rooms, and a possible kiva site in the center courtyard.



LASL archeologist Charlie Steen: "There's no need to dig at this site."

When a community moved, it took almost everything along, swept the floors clean, and sealed fire pits with adobe mud.

displays the differing skills and personalities of various builders. Some walls show the use of copious amounts of mud mortar with small chinking stones set between courses. Other walls display oblong, more carefully cut stone bricks. Interior walls were hand-plastered in mud.

Wayne Hansen, leader of the Environmental Surveillance Group (H-8) to which Steen is a consultant, explained that the idea for a public tour in a security area began in the fall of 1978. Ken Braziel, DOE's Los Alamos manager, had said such visits should be arranged. Hansen worked closely with the WX-Division's Robert Drake and WX-3's Lee Hilton, along with W.C. Courtright of the safety office at H-3. The goal was to mark a trail that would ensure that visitors' safety would not be impaired by proximity to testing areas. WX-Division conducts research at S-Site, where Nakimuu lies.

"A lot of paperwork followed," said Hansen, and members of the appropriate LASL groups walked what seemed to be the best route, marking it eventually with bits of plastic ribbon. Visitors met at the S-Site parking lot, where they were checked on a roster by a security guard. A short bus ride later, they headed off into the woods, down a creek valley and up the other side, then down the mesa to the ruins.

Part of the marked trail included a trek down and across a ravine.

In the future, said Hansen, two tours a year are planned to archeological sites behind security fences. The tours will be in the spring and the fall, but no specific places or times have yet been given. There are many other such sites that would interest the public, he said. PUB-2 will again be arranging for buses, reservations, and publicity.

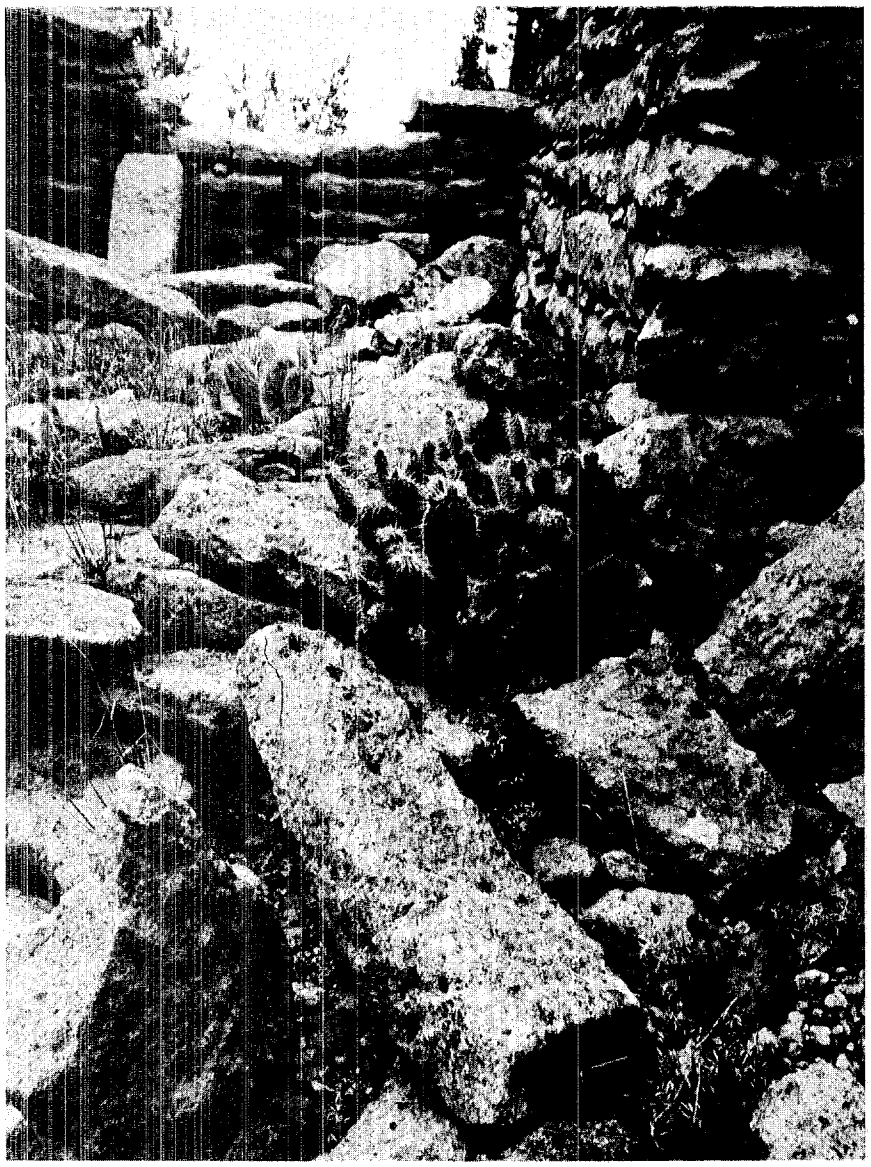
The first recorded visit by a white man to Nakimuu was in 1908 by Edgar Lee Hewitt. Nakimuu is now, as then, the best example of preserved Indian ruins on the Pajarito Plateau.

There are no plans for archeological digs at the site, including excavations that could determine whether a kiva exists. "There's no need to dig at this site," said Steen. "It's a beautiful place. We'll just leave it as it is."

— JLP

Standing walls are part of the site's uniqueness. In one room, a roof apparently burned, turning the interior plaster into a baked substance that still shows the fingerprints of the workman.

'It's a beautiful place. We'll just leave it as it is.'



Cacti have made a few inroads into the Nakimuu ruins. When Indians left, they took roof viga poles and swept the floors clean.

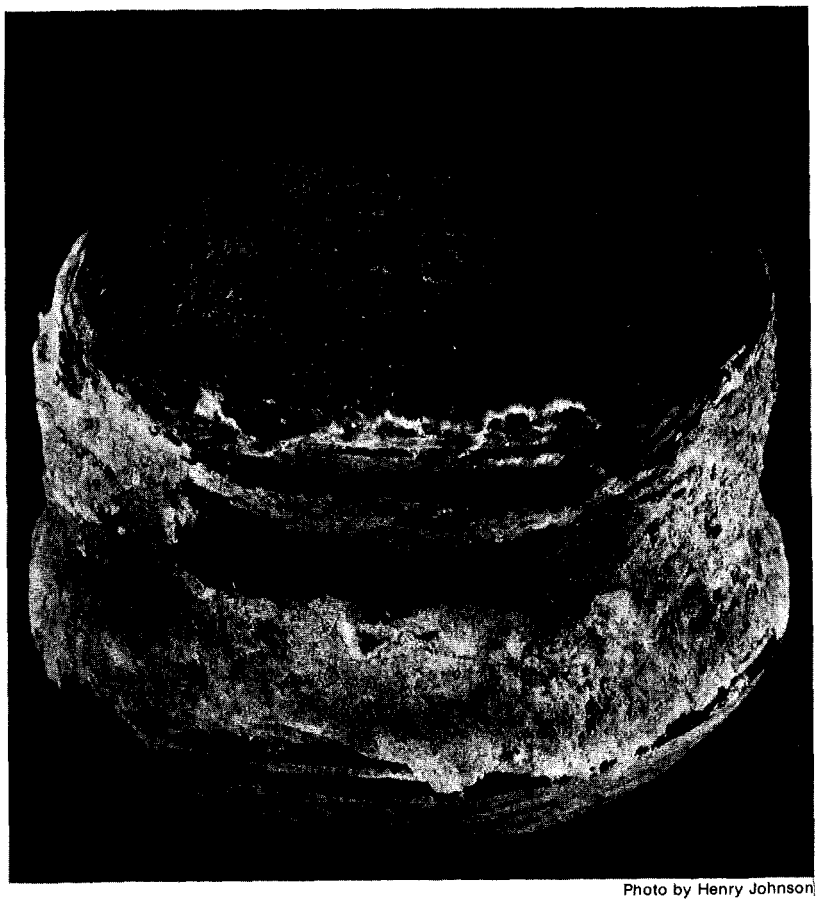


Photo by Henry Johnson

The two pots were sealed with the only known use of lime plaster found so far in the Southwest. Other sealed pots were used only for food storage, not for ceremonial purposes.

Neutron radiography showed cord-like forms and feathery tracings inside the pots, before a small hole was drilled.

Indian pots sealed in 15th century

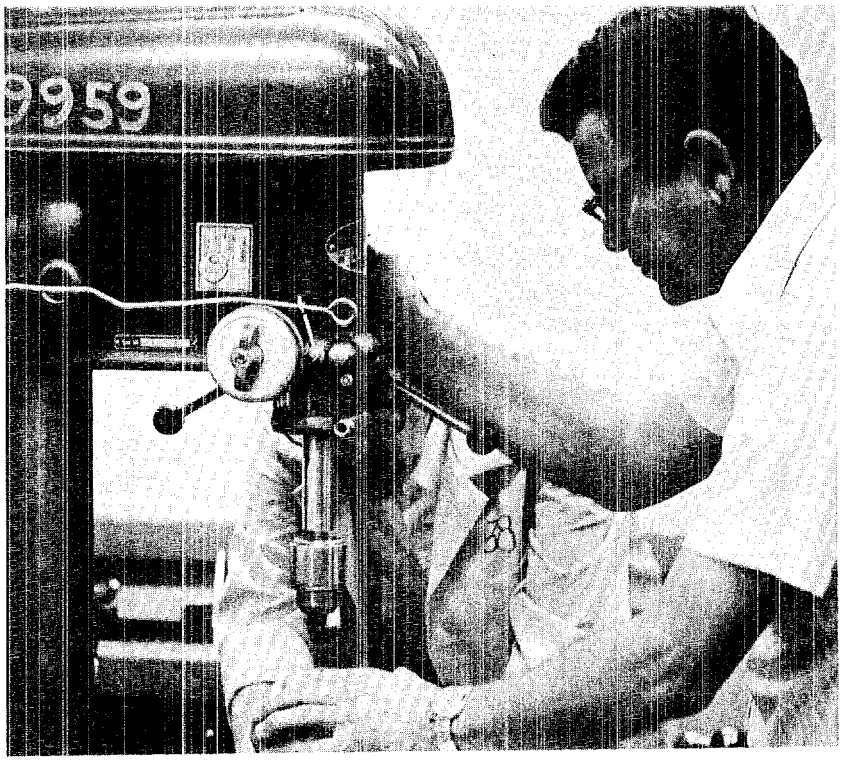
Last year, Danny Ridlon and a friend of his were exploring an area of White Rock Canyon. In a small cave, they discovered what appeared to be two old Indian pots, their openings turned toward each other, a band of cement encasing the joint.

The find may well be of great significance. "As far as I know, this is the first instance of lime plaster being used by prehistoric Indians in the Southwest," said Charlie Steen, LASL archeologist. "And it is unusual in that the pottery was sealed for a purpose other than food storage."

Danny and his father Rae, who works in Group H-7 of the Health Research (H) Division, decided not to separate the pots. Instead, they contacted Steen. In May, Jack Fullbright of Group M-1 conducted a series of nondestructive tests on the two pots. X-rays gave the outline, showing how one pot rim fit over the other pot rim. Neutron activation analysis showed feathery-looking contents inside.

June 1, the pots were subjected to further scrutiny at LASL. A small hole, about an eighth of an inch in diameter, was carefully drilled through the top pot. An optical borescope, a slender metallic rod with a light at one end and an eyepiece at the other, was inserted. For the first time since the 15th century, persons were able to see beyond the "Glaze II" polychrome designs on the surface.

Inside, feathers of several different colors, ranging from reddish to white to soft orange, could be seen. Yucca plant-like fibers, twisted into cords, also came into view. The feathers and other samples, small bits of which were gingerly pulled from the pot with a fine wire, will be sent to the Smithsonian for



After X-rays had been taken, and neutron radiographs performed, a decision was made to drill a hole about an eighth of an inch in diameter into one pot. Jack Fullbright helped to hold the assembly while Buddy J. Montoya carefully applied drill press pressure.

Photo by Vic Hogsett

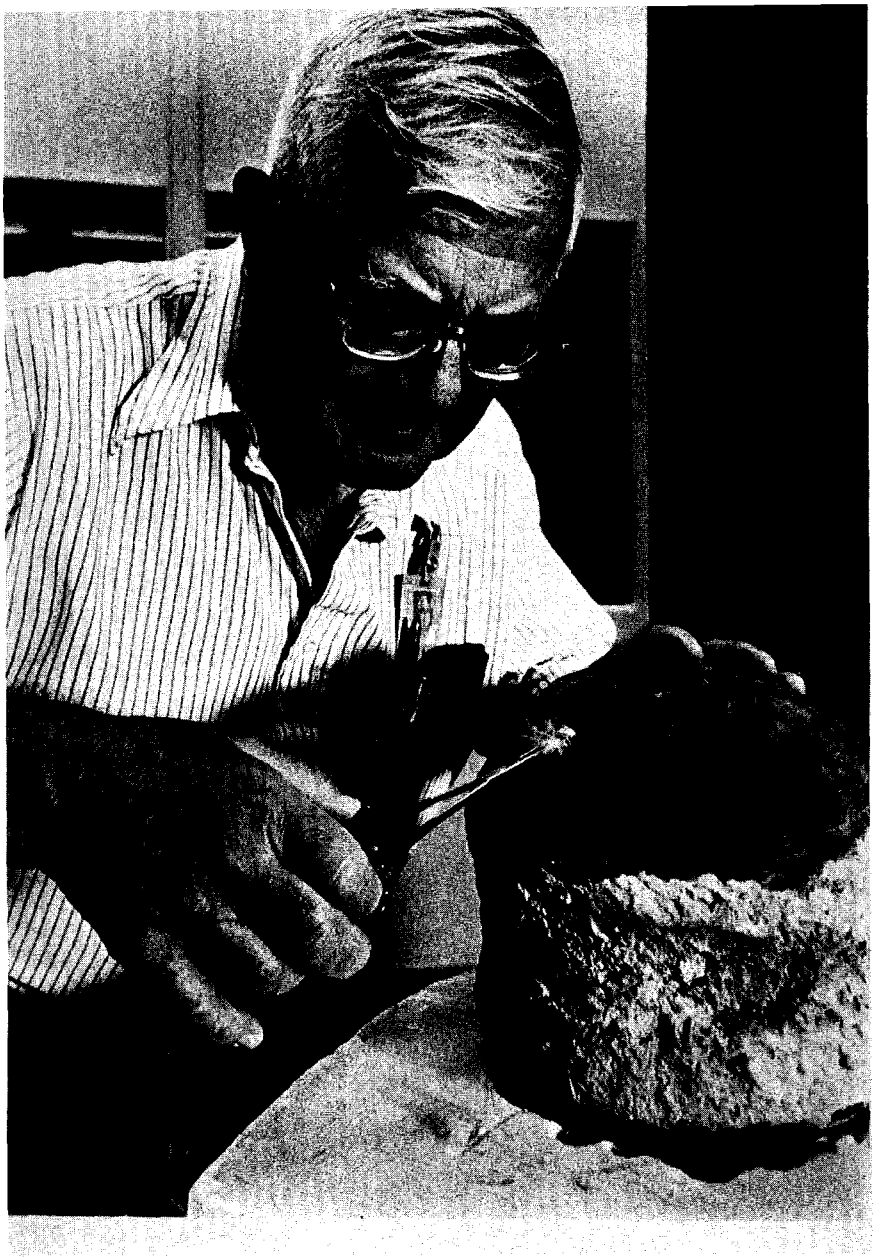
Danny Ridlon, co-finder of the pots, overlooking White Rock Canyon. He and his father were unable to find again the site of the discovery.

Photo by LeRoy N. Sanchez

'As far as I know, this is the first instance of lime plaster being used by prehistoric Indians in the Southwest.'

With the optical borescope, Fullbright and Ridlon took turns viewing the pots' interior. Red feathers and yucca cord appeared to be the main treasures inside.

Photo by Vic Hogsett



Charlie Steen, LASL archeologist, gingerly removed a small feather sample still bound with a bit of yucca cord from the hole in the pot. The red feathers have been tentatively identified as that of the macaw, meaning trade must have existed between the Pajarito Plateau Indians and those of central Mexico or Central America.

Photos by Henry Johnson

ornithological and other analyses. The feathers have been tentatively identified as belonging to the macaw, which would make them imported; they could also be from an indigenous species like the flicker.

It appears that the contents contain feathers bound together with the yucca cord. Until more is known, the purpose can be termed "ceremonial," and the collection called a "medicine bundle." Whoever placed the contents inside the pots and cemented the containers together certainly never expected to open the package again.

Ridlon, Steen, and Fullbright don't intend to open the package either. It may end up in the Bradbury Science Hall, said Ridlon, on a long-term loan.

The yucca cord inside, said Fullbright, "looks as fresh as if it had been made yesterday."

The sealing material around the pots' openings, said Steen, is a prepared lime plaster. This use hasn't been reported before in the Southwest, but the Indian inhabitants were known to have boiled lime with corn.

"They knew what happened when you hydrated lime, although roasting, and then added water again to form plaster," said Steen. Other sealed pots have been found, but they were used for food storage. Other seals have been found on pots, but they are of adobe mud.

For now, the pots' contents will be left as is for analyses by LASL or other investigators. The seal will not be broken; if it were, the discovery's significance would be lost.

Ridlon and Danny returned last winter to White Rock Canyon but were unable to relocate the site where the pots were found.

— JLP

Donald M. Kerr, Jr.: LASL's new Director

A new director has been named to head the Los Alamos Scientific Laboratory. Donald M. Kerr, Jr., will assume his duties July 30.

Kerr is only the fourth Director in the Laboratory's 36-year history. Like his predecessors, he has a doctorate in the physical sciences. His background includes weapons work, but unlike previous Directors, Kerr was not associated with the design and construction of the first atomic bombs at "Project Y" in Los Alamos. Kerr, LASL's second-youngest Director, was in early grade school when World War II ended.

Also in contrast to his predecessors (J. Robert Oppenheimer, Norris Bradbury, and Harold Agnew) Kerr has served in Washington, D.C. where he recently has been the Acting Assistant Secretary for Energy Technology in the Department of Energy. Asked this month whether that experience would help his administration at LASL, he said, "You have to adapt to the environment. The bureaucracy is a given, which must be accepted. Having been responsible for some of the bureaucracy myself, I can perhaps swim in those waters with some success."

At his current post, Kerr has been responsible for the national technological development programs in the areas of nuclear waste management, fossil energy, solar and geothermal energies, nuclear energy, and controlled fusion. These activities are carried out by industry, universities, and the DOE at current support levels of $3.6 billion.

He seems eager to assume his new post, one that has proven demanding of a Director's time, political knowledge, scientific expertise, and organizational skills.

Already he has been part of the national political spotlight, testifying before Congressional panels on the effects of low-level radiation from atmospheric testings and on nuclear terrorism and safeguards — a subject for which he calls LASL a "lead laboratory."

But the most press has come from California Gov. Edmund G. Brown, Jr.'s telegram to President Jimmy Carter, calling for the rejection of Kerr's appointment to head LASL. (Brown also called on University of California Regents to drop ties with the weapons laboratories, but that move lost on a 15-7 vote, with one abstention, on July 20 in San Francisco).

Kerr last August 28 told a subcommittee of the House Armed Services Committee that a total ban on underground nuclear testing "in the long run would inevitably result in a steady decline of our nuclear deterrent and risk a steadily growing asymmetry between United States and Soviet military forces." Gov. Brown said this stance was not that of the Carter Administration and said Kerr's appointment "does not make sense."

Kerr later upheld this position and said that a three-year ban on underground tests would be wiser than a five-year ban. He also said he was proud of his selecton by the Regents, and questioned the governor's characterization of the new Director as "however otherwise undistinguished." Said Kerr, "If I'm that unqualified, I'm certainly handling a lot of taxpayers' money. One should look into it."

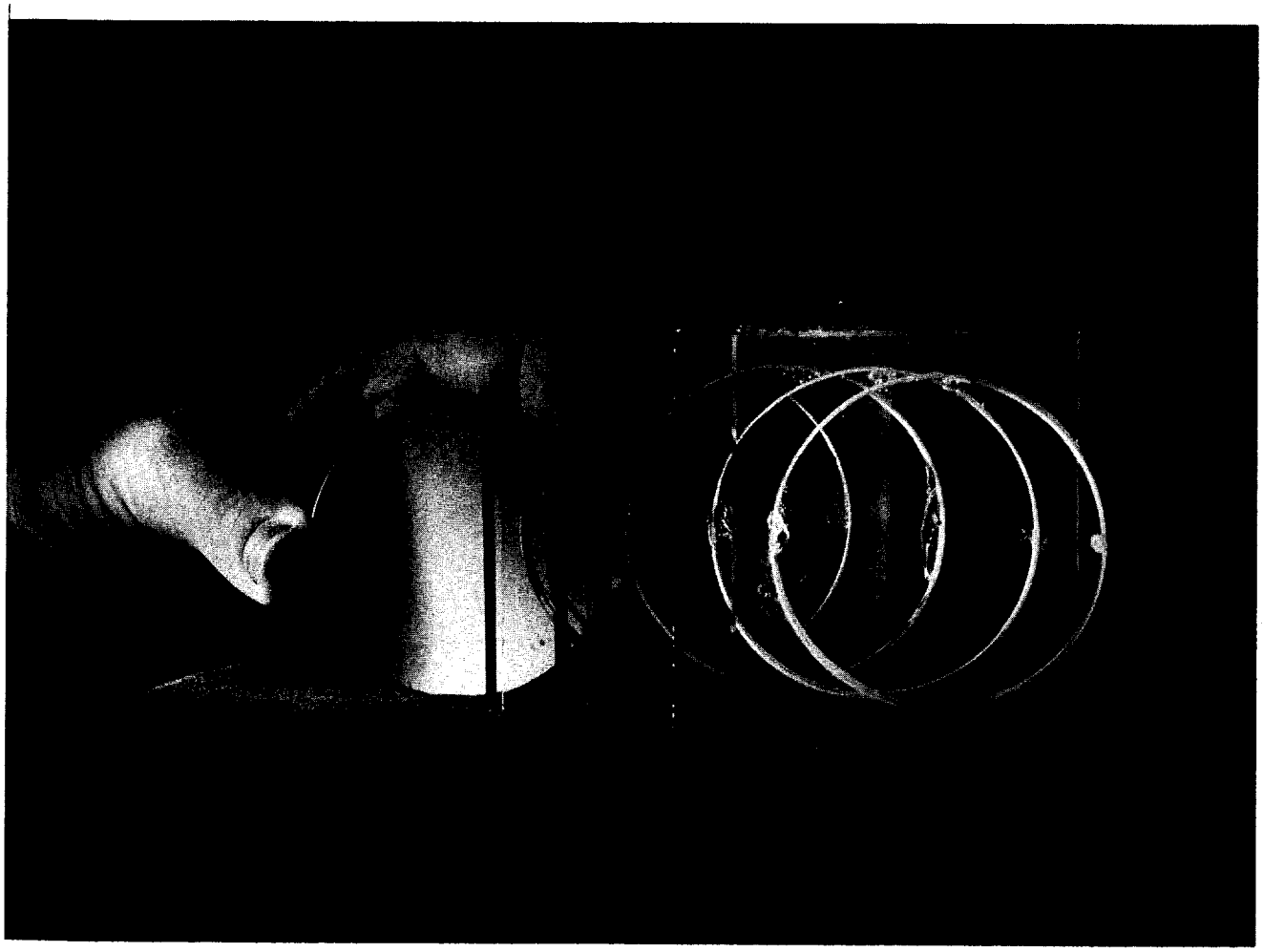
Kerr's appointment has also drawn the concurrence and praise of many, including scientist Hans Bethe; Lawrence Livermore Director Roger Batzel and former Livermore director Michael May; University of California President David Saxon; and Kerr's present boss, John Deutch, who is the DOE's Acting Undersecretary.

Kerr said he plans to outline his program and management philosophies in some detail in the near future. He is moving to Los Alamos permanently July 29, with his wife Alison, and his daughter Margot, 13.

In June of 1966, the Director received his Ph.D. in plasma physics from Cornell University, where he previously earned B.E.E. and M.S. degrees. The next month, he became a staff member in LASL's J-10 group, studying high-altitude phenomenology. In 1971, he was appointed J-10 group leader. He participated in atmospheric and nuclear test experiments at the Nevada Test Site, and conducted studies for government operations in the Pacific. He was also scientific advisor for underground tests at Nevada.

In October of 1972, Kerr was appointed assistant J-Division leader, and was made an assistant for research under Richard Taschek in September of 1973. He became alternate Energy Division leader in July of 1975, responsible for LASL's geothermal program, basic geosciences, solar energy, and a systems analysis group. In August of 1976, Kerr was named deputy manager of ERDA's Nevada Operations Office, which manages the test site 65 miles northwest of Las Vegas.

The Director was the recipient of a Ford Foundation Fellowship and a Jane Clark Maxwell Fellowship, and is a member of three major scientific organizations. He is a native of Philadelphia.



Photos by LeRoy N. Sanchez

A germanium mirror is posed behind a grouping of calibrated optical attenuators, each mounted in a plastic holder.

Phase-conjugator retraces optical path

By Jeff Pederson

As laser fusion work progresses at Los Alamos, many technical problems remain to be solved. How, for instance, does one perfect the quality of these extremely powerful beams of light and precisely focus them on a miniscule fuel target?

Four researchers have reported a technique that helps to "trim" and direct carbon dioxide laser beams, without the need for optical elements of the highest quality and greatest expense. The technique is called "phase-conjugation reflection." The researchers have demonstrated the effect with infrared light using a process known as "degenerate four-wave mixing," in a piece of germanium.

A light beam interacting with a phase-conjugator is reflected in such a manner that it retraces its optical path. If you looked into a conventional mirror, you would see your face. If you looked into a phase-conjugate mirror, you would see only the pupil of your eye. This is because any light reflected from other parts of your body is returned to those parts, and is not directed toward your eye.

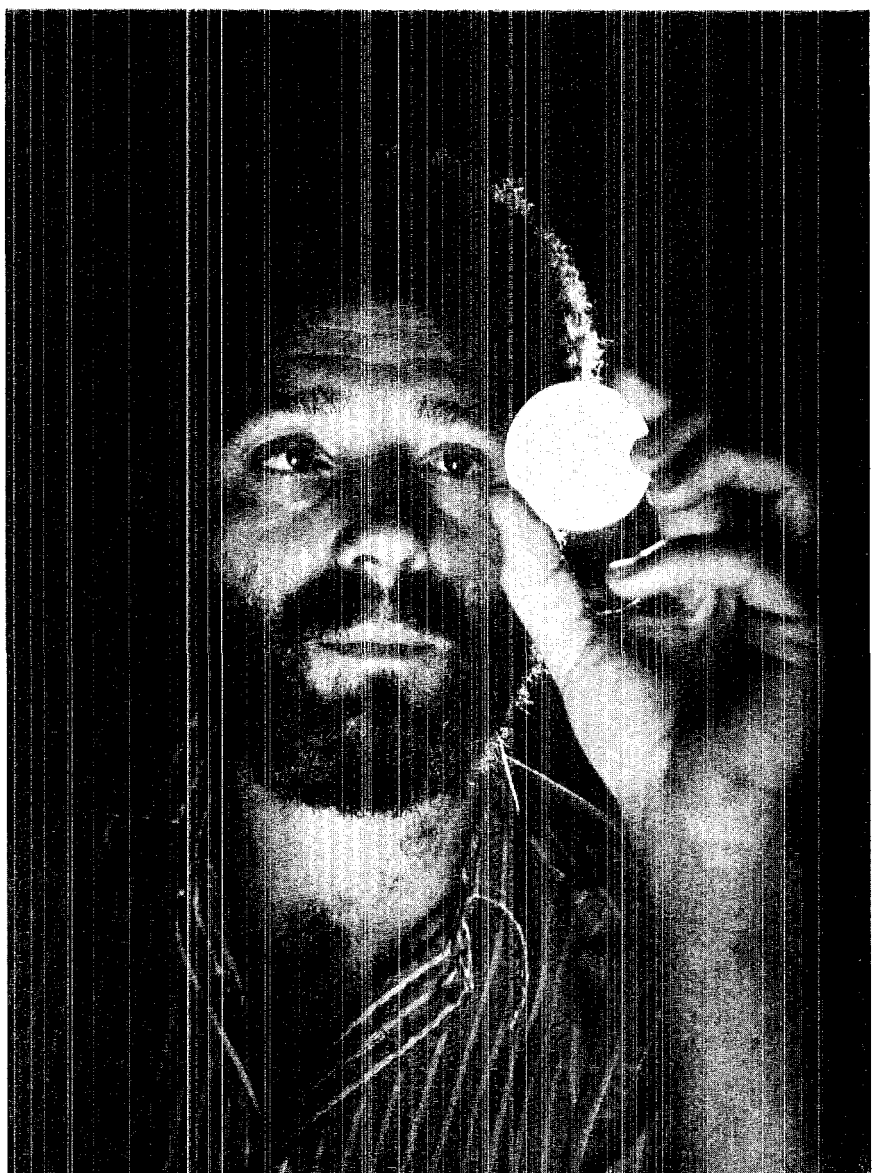
These unusual reflective properties of phase-conjugators remain, even though a highly distorting optical material is placed between your eye and the conjugator. This insensitivity to distorting materials gives phase-conjugate reflectors many new practical applications.

This reflection technique was reported for the first time, using infrared light, by Barry J. Feldman and Robert Fisher of Group L-9; by Irving J. Bigio of Group L-1; and by Ernest E. Bergmann, a visiting staff member from Lehigh University, who collaborated with the Los Alamos researchers. More recently, Fisher and Feldman have extended the technique to obtain infrared phase-conjugation in inverted carbon dioxide molecules, which have "gain" and are created temporarily in carbon dioxide lasers. Laboratory work has been in the Laser Research and Technology (L) Division at Los Alamos Scientific Laboratory.

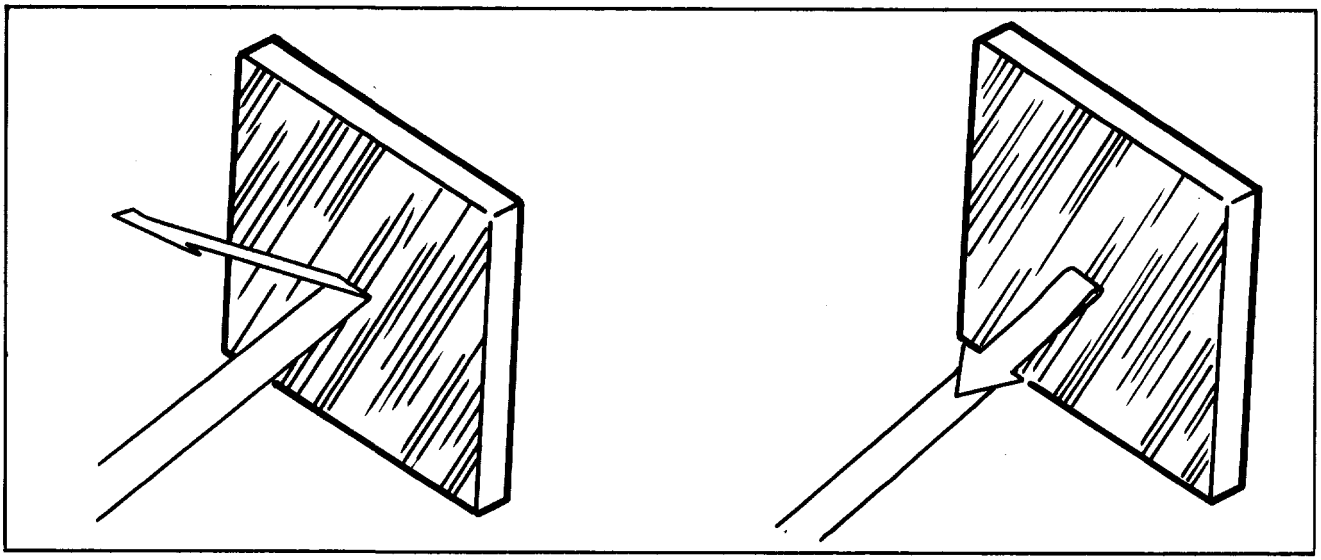
Before the L-Division work, optical phase-conjugation had only been performed using visible light. The procedure involved the careful alignment of intersecting laser beams in a special material. Since laser fusion work at LASL involves carbon dioxide lasers, the researchers hoped to demonstrate the effect in the invisible infrared wavelengths. In the infrared part of the light spectrum, however, the conjugation effect is significantly reduced compared to that for visible light, since the effect decreases with increasing wavelength.

The careful alignment of the necessary invisible beams, in addition, posed extra difficulties. To circumvent these problems, the researchers developed an intracavity technique, where the special material is placed inside a laser cavity. This automatically provided the precise alignment required of the various beams, and increased the power delivered to the sample.

Barry Feldman holds a highly reflective germanium mirror.

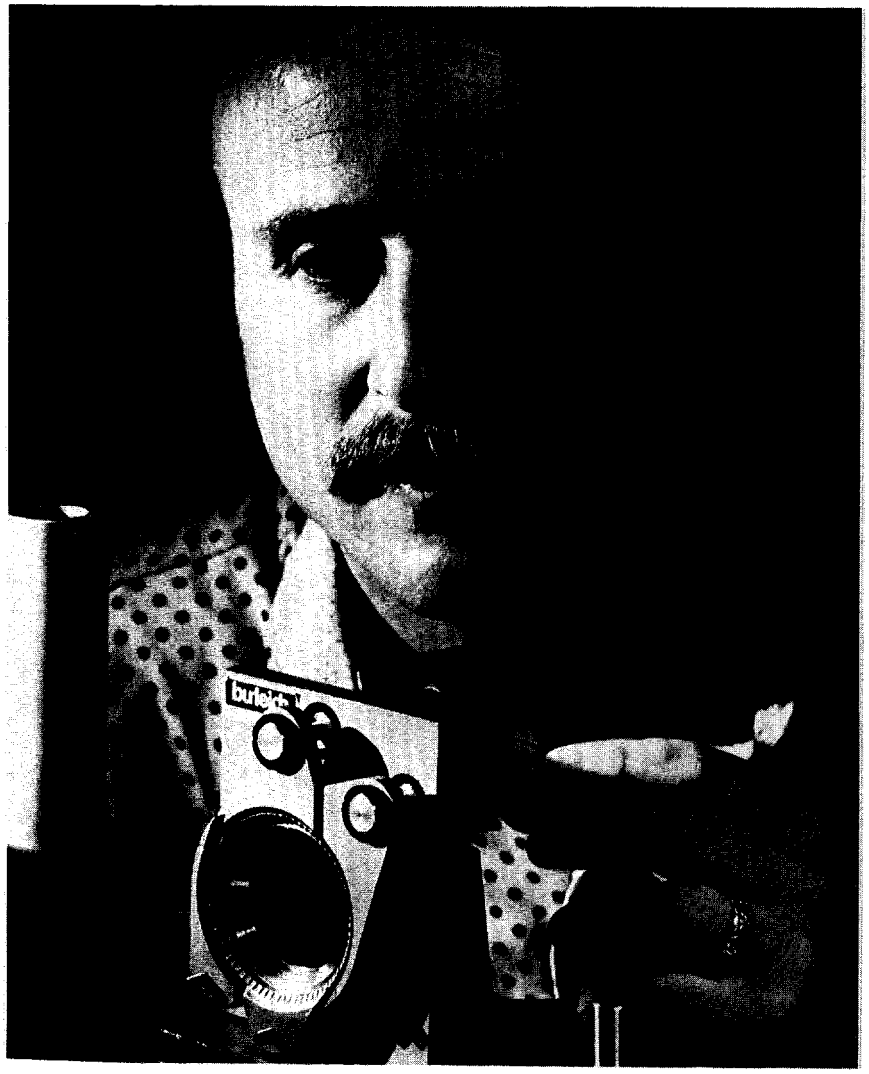


If you looked into a phase-conjugate mirror, you would see only the pupil of your eye.



Comparison of reflections from a conventional mirror and a phase-conjugate mirror.

Other research fields that may benefit include power transmission to a satellite; atmospheric propagation; image restoration; real-time holography; and fiberoptics.



Bob Fisher adjusts the position of a germanium conjugator with a micrometer.

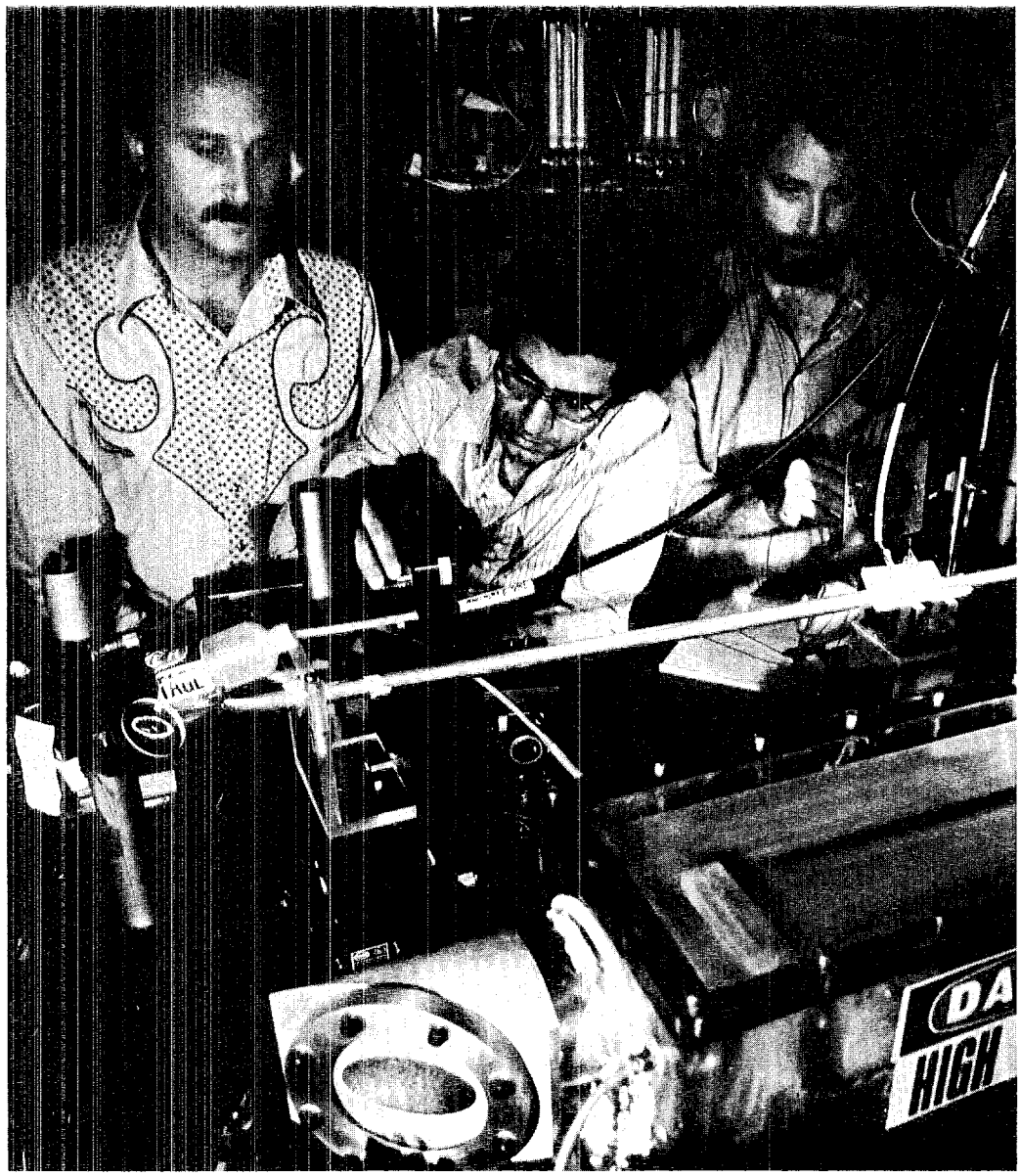
This work could result in large payoffs for the laser fusion program, which seeks to duplicate the reactions occurring in the sun, but under controlled conditions.

In conventional laser fusion experiments, an oscillator pulse is sent through an amplifier system and is then focused on a very small pellet of deuterium-tritium fuel. In contrast, conjugation techniques would start by illuminating the target with an auxiliary pulse. Some of the incident radiation would be scattered back into the main laser system, would be amplified, and would strike a conjugator. The unusual retro-reflective property of the conjugator would program the beam to return through the amplifiers and make a direct hit on the target. High quality optical components may then not be needed; this offers great potential savings over the conventional approaches.

Before the conjugation technique can be considered for a major laser system, such as the 72-beam Antares now under construction, more testing will be required, said Fisher. Other research fields may also benefit, including the transmission of power from earth to a satellite; atmospheric propagation; image restoration; real-time holography; fiberoptics; and others.

"We are continually working on new techniques, new avenues," said Feldman. Exploration could lead to improved quality, for instance, of the laser process by which isotopes are separated.

An intracavity technique provided the precise alignment of the various beams.



Bob Fisher, Irving Bigio, and Barry Feldman adjust the orientation of a helium-neon alignment laser.

Voelz recounts Silkwood tests

George Voelz, head of LASL's Health Research (H) Division, recounted Laboratory analyses of the plutonium exposure of Karen Silkwood at a recent colloquium that was filled to the doors.

Voelz testified several days at a trial in Oklahoma City, where on May 18 a federal jury awarded $10 million in punitive damages and $505,000 in actual damages to the Silkwood family and against the Kerr-McGee Corp., her former employer. Silkwood was a lab technician at a fuel reprocessing plant in Crescent, Oklahoma. The trial court decision is now under appeal.

"We got a call from Kerr-McGee on a Friday, November 8, 1974, and within two minutes we knew it was unusual," said Voelz. The firm wanted the Laboratory to perform lung and body counts on Silkwood; the request was approved by the Atomic Energy Commission (now Department of Energy).

Voelz said some contamination had been found November 5 on Silkwood's hands and her handling gloves; she was sent home and no glove leaks were found. November 6, some skin contamination of hands was again found although she performed no glove box work that day. Each day, her skin was decontaminated successfully. November 7, tests on silkwood were positive when she arrived at work and radioactive contamination was later found in her apartment.

November 10, Silkwood and two friends arrived late in Los Alamos for tests, which were conducted by H-Division on November 11 and 12. The next evening, Silkwood was found dead at the site of a one-car auto crash in Oklahoma.

The next day, November 14, a LASL team of four persons went to Oklahoma to assist in the post-mortem examination.

During her visit to LASL, Silkwood had "looked normal, but was concerned about her exposure," said Voelz. LASL at that time found 0.34 nanocuries of americium-241 in her lungs, and an estimated six to seven nanocuries of plutonium. This compares with a permissable lung burden for workers of 16 nanocuries, said the physician. Samples of feces showed progressively lower readings during the two days at LASL and plutonium in the urine was barely detectable. "It was clear she had ingested in some way plutonium in the intestinal tract," said Voelz.

Silkwood had been told by LASL that she had, at most, half of the permissible activity level set by the U.S. government. The later autopsy figures corresponded well with this assessment, said Voelz. Silkwood was found to have no more than 10 nanocuries in her body, whereas 40 nanocuries is the maximum permissible limit for workers. A Nuclear Regulatory Commission report of the incident said the contamination probably did not result from an accident or incident within the Kerr-McGee plant, and that no contamination had been found outside her apartment.

Voelz noted that the case was first filed for $165,000 in 1976, with $25,000 asked for damages and the remainder for alleged civil rights violations. The amount asked for punitive damages later rose to $70 million.

Voelz also talked about 26 men who in 1944-45 received plutonium exposures at Los Alamos above that measured from Silkwood. According to a risk estimate method used by one witness for the plaintiffs, said Voelz, these exposures should have caused 65 lung cancers by now. In fact, there have been two skin cancers, one a pigmented mole and the other a common variety, both treated successfully. Two of the 26 have died, but not from cancer.

Of 224 "highest exposed" persons at Los Alamos since 1943, all checked in 1976, 32 have died, versus a prediction, based on U.S. male statistics, of 61, said Voelz. Of 11 expected cancers, again under normal, non-radioactive situations, only seven have occurred.

One thing should stand as fact in what can be considered a partly "inexplicable" case, said Voelz: "There was no significant health risk in this particular case." Kerr-McGee, however, was found "strictly liable" for contamination that occurred outside its plant, the first such holding of this kind, to Voelz's knowledge.

Short subjects

University of California Regents voted 15-7, with one abstention, to continue managing the nation's two weapons laboratories for the Department of Energy at a sometimes stormy meeting July 20 in San Francisco.

They defeated a motion by California Gov. Edmund G. Brown, Jr., who is an ex-officio Regent, to sever weapons ties and to seek retention of Lawrence Livermore Laboratory for non-weapons work.

University President David S. Saxon maintained the management contract was in the "best interests of the nation," and a majority of Regents agreed. Those who dissented said the contract was not in keeping with the prime university roles of education and advancement of society.

More than 100 demonstrators from the UC Weapons Labs Conversion Project carried signs outside the Extension Center during the meeting. Comments, pro and con, came from faculty members and Regents. No representatives from either laboratory were on the agenda to speak. More extensive coverage of the meeting was in the July 25 edition of the *LASL Newsletter.*

* * *

Jim Blacic and Phil Halleck of Group G-6 are now contributing to the Porous Media Reservoir Stability Criteria studies at Pacific Northwest Laboratory. Their work focuses on determining structural properties of sandstone materials at confining pressures and temperatures typical of compressed air energy storage reservoir operation. Their test equipment includes a sophisticated high temperature apparatus that allows monitoring of interstitial conditions in the porous test samples. Sandstones from gas storage fields in Illinois are the planned test material and cores for testing are currently being prepared. Loading conditions will include a range of temperatures and confining pressures, and the unique portion of the tests will include cyclic stresses similar to those indicated in previous structural numerical analysis at Pacific Northwest Laboratory.

* * *

Louis Rosen was elected vice president of the community-based New Mexico Cancer Control Program Board at its recent third annual meeting. He is the leader of MP-Division, which operates the Los Alamos Clinton P. Anderson Meson Physics Facility. Rosen, the author of 95 scientific publications, is also a member of the USA-USSR Joint Committee for the Collaboration on the Fundamental Properties of Matter.

* * *

The first in a series of books in science fields has been published by the University of California Press. "Detonation," written by Wildon Fickett and William C. Davis, both of the Dynamic Testing (M) Division, provides a review of the theory of detonation. Two other volumes are scheduled for publication. They are "Numerical Modeling of Detonations," by Charles L. Mader of the Theoretical (T) Division, and "The Theory of The Structure and Spectra of Complex Atoms," by Robert Cowan, also of T-Division. LASL physicists David H. Sharp and L.M. Simmons will edit future volumes in collaboration with University of California Press senior editor Grant Barnes.

* * *

The 8th annual Oppenheimer Memorial Lecture will be Monday, August 20, at 8 p.m. in the civic auditorium (at the Los Alamos High School). Murray Gell-Mann will speak on "Quarks and Other Fundamental Building Blocks of Matter" at the free talk. Gell-Mann, who is a LASL consultant from Cal Tech, won the Nobel Prize for physics in 1969.

Patents awarded

Patents have been awarded to LASL researchers in four recent instances.

Patent 4,138,622 or "High Temperature Electronic Gain Device" was awarded to J. Byron McCormick, Steven W. Depp (both of LASL), Douglas J. Hamilton, and William J. Kerwin (both of Tucson, Arizona). The abstract states that the integrated thermionic device is suitable for use in high temperature, high radiation environments. Cathode and control electrodes are deposited on a first substrate facing an anode on a second substrate. The substrates are sealed to a refractory wall and evacuated to form an integrated triode vacuum tube.

Patent 4,144,464 or "Device and Method for Nonresonantly Raman Shifting Ultraviolet Radiation" was awarded to Thomas R. Loree and Dean L. Barker of LASL. The abstract states that this is a device and method for nonresonantly Raman shifting broad band uv excimer laser radiation, which enhances preselected Stokes signals by varying the pressure of the Raman scattering medium, the focal interaction length of the incident radiation within the Raman scattering medium, and its power density level.

Patent 4,146,449 or "Purification of Silane Via Laser-Induced Chemistry" was awarded to John H. Clark and Robert G. Anderson, both of LASL. The abstract states that impurities may be removed from silane by means of selective photolysis with ultraviolet radiation of the appropriate wavelength.

Patent 4,148,612 or "Method and Apparatus for Detecting and Measuring Trace Impurities in Flowing Gases" was awarded to Gene W. Taylor and Edward J. Dowdy of LASL. The abstract states that the impurities may be detected and measured by a dynamic atomic molecular emission spectrograph utilizing as its energy source the energy transfer reactions of metastable species, with the impurities in the flowing gas.

Photo by Bill Jack Rodgers

Americans and their leaders believe that no side can win a nuclear war, said history professor Richard Pipes, but the Soviet Union feels differently.

Salt II a Mistake, Says Pipes

If America signs the Strategic Arms Limitation Treaty, SALT II, we will be in a weak national situation and perhaps "victims" of the Soviets, speaker Richard Pipes recently told a LASL colloquium audience.

Pipes is a Polish-born American who is a history professor at Harvard University. He has also served as director of the Russian Research Center there. He said the Soviets believe they can conquer America by launching an unpredicted nuclear offensive, if they felt it was necessary.

While Americans and their leaders are convinced there can never be a nuclear war, because total destruction of both sides would result, the Soviets feel differently, Pipes said. Russian leaders see nuclear weapons as useable equipment, and they have been building their arms arsenal steadily, he said.

If the United States increased its military capability before signing a SALT II agreement, the speaker said, the Soviet strategy could change. If both nations reached arms parity, then talks dealing with arms control could proceed.

SALT II negotiators did not respond favorably to this line of reasoning, said Pipes, because they believe that after a nuclear war, nothing will be left anyway.

He went on to say that SALT II backers, including President Jimmy Carter, are genuinely inspired, but don't understand the issues at hand. What is needed, he averred, is a "counter-force" strategy if we don't want to come out second best in the nuclear arms confrontation.

History should tell us something of Russian motives and military philosophy, said Pipes. In World War II, for instance, German troops advanced nearly to Moscow before they were caught by the winter weather and a decisive pincer campaign at each flank.

In a similar way, Soviet leaders might allow devastation of civilian and military centers, while they waited for a second strike against the U.S., said Pipes.

He further argued that only military power has enabled Russia to remain a "superpower," and disarmament would mean second-class status in the international community for the Soviet Union.

Their society is "mobilized for war," he concluded.

Among our visitors

Photo by John Flower

Donald Casperson of Group L-1 gave a tour of laser facilities to master's candidates from the Air Force Institute of Technology at Wright-Patterson Air Force Base. After they receive their degrees, the students often are assigned to positions at places like the Air Force Weapons Laboratory or the Defense Nuclear Agency.

Cid Garcia, left, from San Juan Pueblo, adjusted traditional headgear on two Laboratory visitors during a social gathering at Fuller Lodge. Yoshisuke Aibe, center, and Hiroshi Akita, right, were among the many Japanese governmental and business leaders here recently to learn more about LASL's hot, dry rock geothermal program. Garcia is a member of the pueblo's Indian dance group.

Photo by LeRoy N. Sanchez

Richard Taschek, former associate director for research, left, met visitors at the Los Alamos airport. They were U.S. Sen. Pete Domenici (R-NM) and John Deutch, acting assistant secretary for energy technology in the DOE, respectively. At far right was Peter Wellish, Domenici's press aide. The visitors were among a small group that was briefed on a wide range of LASL research topics during a day-long stay. Taschek retired in July.

Photo by Bill Jack Rodgers

10, 15, 20 years ago

20 years ago

A time to remember

July 16, 1945 was the day the first atomic bomb was fired by a tense and uncertain group of Los Alamos men. Writers and historians have since referred to it as "a new age, the atomic age." Looking back, Los Alamos people remember unbearable tension, the awesome spectacle of the explosion, the mixed feelings of disbelief, pride, and apprehension.

Dorothy McKibbin of the Santa Fe office, the Laboratory's first employee and guiding hand since 1943, knew what was happening only through intuition. As many as 70 people checked in at 109 East Palace every day, and once she counted 100 phone calls.

To avoid tipping off the public, Director J. Robert Oppenheimer sent this veiled invitation to A.H. Compton in Chicago and E.O. Lawrence in Berkeley: "Anytime after the 15th would be good for our fishing trip... As we do not have enough sleeping bags to go around, we ask you please not to bring anyone with you."

Secrecy surrounded the project. No one could write letters, and only five people could telephone between Trinity, in southern New Mexico, and Los Alamos; calls were routed through Denver, Albuquerque, and San Francisco. Pilots were told only to avoid the test portion of the Alamogordo Air Base bombing range. As a result, two dummy bombs were dropped one night on Trinity camp. Another day, a group of electricians came in from the field to quit and threw down a handful of machinegun bullets that had been splattered at their feet during strafing practice.

15 years ago

Kiwi test success

Disassembly and analysis of the Kiwi-B4-D confirms that the nuclear rocket reactor core was not damaged during the full power test conducted at the Nevada Test Site in May. The only structural damage was confined to a crack in a graphite slat and is regarded as minor. The reactor operated at near design power and temperature for about 100 seconds. It is the seventh in a series tested by LASL in the Rover program — the nation's effort to develop a nuclear rocket for space travel.

Data from Vela

Clouds of high speed electrons, far in space, have been discovered by the orbiting Vela Hotel satellites and may be of great importance in mapping the earth's magnetic fields. The clouds appear to be in a pancake-shaped area, perhaps 10,000 miles thick and 35,000 miles across. They show particle velocities of more than 60 kilovolts and occur about 65,000 miles out from the earth. On the basis of present data, the clouds have much less radiation intensity than the closer Van Allen Belts.

Electronic eyes

LASL had probably the first closed circuit television in the country, long before most residents had ever seen such a picture. They were used for remote operations with fissionable materials. Experimental equipment was brought in in 1946 and LASL worked with other setups. Persons observed good pictures, but couldn't change lenses or pan or tilt during an experiment.

10 years ago

Glassblowing art

A skilled art, with processes basically unchanged in 4,000 years, plays an important role in many LASL programs. Scientific glassblowing relies on a sharp eye and skilled hands. Glass is not made here, but two glassblowing shops buy ready made items and convert them to specifications of researchers. Pyrex is easy to work with, compared to quartz glassware, and can be shaped at 1,200 degrees C. Quartz glass has a working point temperature of 3,000 degrees C. It has a greater thermal durability and is called for in half the jobs at SD-3.

Glasstone plans move

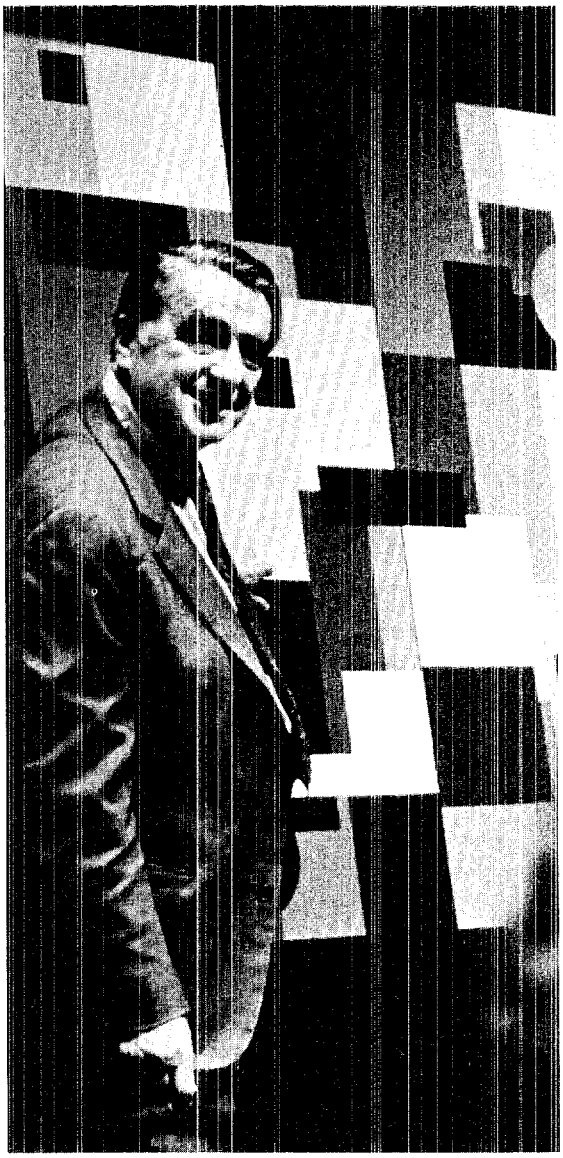
Samuel Glasstone, author and lecturer here, will move to Tennessee where he will continue to work under AEC contract at Oak Ridge. After writing his "Sourcebook on Atomic Energy," he came to Los Alamos for a few months in 1949 to prepare his book "The Effects of Atomic Weapons," one of more than 30 he has authored to date. He has been at LASL since 1951, and taught the first courses offered at the Los Alamos Graduate Center on reactor technology in 1952-53.

Adaptation for cancer treatment

The waveguide accelerator, a system invented at Los Alamos for accelerating protons to great energies, has impacted the medical field. It has been adapted from the Los Alamos Meson Physics Facility now under construction, and industry may make small accelerators that hospitals can afford so that cancerous tumors can be treated. The first one was recently put to use at O'Connor Hospital, San Jose, California.

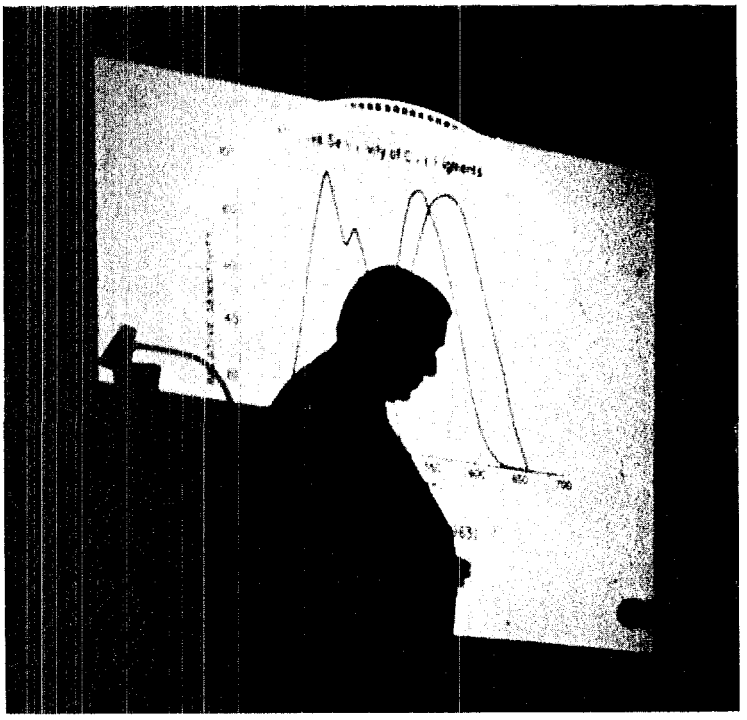
Compiled from back issues of *The Atom* and the *LASL News*.

☆U.S. Government Printing Office: 1979 — 677-050/6



Edwin H. Land, inventor of an instant-imaging photo system, and president of Polaroid Corporation, delivered a special talk here as part of the first LASL Conference on Optics '79. In experiments, he has shown that color is not dependent on the relative amounts of red, green, and blue light coming to the eye.

Photos by Bill Jack Rodgers



A laser fusion display at Fuller Lodge was part of the First LASL Conference on Optics held here this summer. The conference was organized by local members of the Optical Society of America and the Laser Institute of America. Hilary Kendrick of England was one of the visitors; she received an explanation from Ed Yavornik of Group L-10.

Photos by Bill Jack Rodgers